

# PACIFIC DISCOVERY

FIFTY CENTS



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SPRING WEATHER is breaking out in Golden Gate Park and environs—San Francisco and the Bay Area generally—and leading to insidious thoughts of breaking away from routine. It seems that with more people spending more time vacationing, each year it becomes increasingly vital to plan ahead and to reserve space at some place to stay if not space on the highway to get there. In the May-June issue we'll put in some good hard thinking on this matter. Meanwhile, if you have Mexico in mind, we'd like to urge you to write ahead to Mr. and Mrs. Robert Cuba Jones, Chilpancingo 23, Mexico 11, D.F., Mexico. We've had it from a number of people—the S. Paul Londons of San Francisco, for instance—that Casa Jones is a wonderfully congenial place to stay, and very centrally located. Best of all, it is not a commercial establishment, but is indeed a cultural center where you will meet others like yourself who are seeking more than mere *turista* values. More about this, next issue.

*Pacific Discovery* and the California Academy of Sciences will be well represented at the Audubon Convention at Asilomar, California, 25-28 March (see Editorial). Besides Dr. Miller, Dr. J. F. Gustafson, Associate Director, Arthur C. Smith, and D.G.K. will be there. Look for us. We'll look for you.

RUNNING PERTINENT FACTS down to source is a habit of mind with our editorialist Dr. Robert C. Miller, Director of the California Academy of Sciences. It took some sleuthing in a law library with the aid of Academy counsel to unearth the legal authority for the kick-off day, March 7, of California Conservation

Week. Respect for facts is also behind the authority with which Dr. Miller speaks to the topic, "Conservation Can't Wait!" With "The Meaning of Wilderness to Science" the theme of its Sixth Biennial Wilderness Conference (1959—see Reviews, page 30), the Sierra Club enlisted the Academy's coöperation and appointed Dr. Miller conference chairman. . . . ¶ Virtually a commuter between his home, Far Lands House, Danvers, Massachusetts, and some of the remotest islands of the South Pacific at the bottom edge of the Polynesian Triangle, Dr. Donald Stanley Marshall has been among our favorite visitors to *PD*'s editorial office. It is a pleasure to welcome him to these pages also. He represents a young generation of Pacific anthropologists who are testing traditional concepts through hard work in the field guided by hard thinking. His affiliations have been with the Peabody Museum of Salem and Harvard University. . . . ¶ Tucson, Arizona, is home base for the writing team of Annette R. and Hiram L. Parent. Visitors to Petrified Forest National Monument in northern Arizona, this spring, will find Hi Parent there as temporary ranger naturalist. . . . ¶ Fortunate are they—like skilled nature photographer Anna-Jean Cole of Tiburon in Marin County, just north of the Golden Gate—who live close to wild gardens. And fortunate are all of us that a few like Mrs. Cole are dedicated to keeping nature's gardens alive and blooming wherever possible. . . . ¶ In his correspondence with *PD* over "Subantarctic Island," Dr. Alfred M. Bailey, Director of the Denver Museum of Natural History, gives his daughter, Patricia Bailey Witherspoon (our author also, who recently moved from Denver to Colorado Springs when her husband was transferred), credit for a hand in preparation of the article. . . . ¶ *PD* Nature Editor Dr. Arthur C. Smith of Alameda State College, Hayward, has a book coming soon from Lane on California's butterflies—fourth grade level. . . . ¶ Because our senior Astronomy Editor and Morrison Planetarium Manager spends so much of his life with his head among the stars, it isn't easy to find something, every issue, of earthly import to say about him. Happy star-gazing, George!

D.G.K.

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## PRE-DISCOVERY

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THE COVER

LA VAGA, the Arizona-Sonora Desert Museum's ring-tailed favorite was photographed in her new Museum underground home by Ray Manley of Tucson. (See page 9.)

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A JOURNAL OF NATURE AND MAN IN THE PACIFIC WORLD

## Conservation Can't Wait!

THE COMPELLING WORDS ABOVE are the theme of California Conservation Week, March 7-14, 1961. It is a theme that will be emphasized at a meeting of the California Conservation Council in Asilomar on March 25 and at the National Audubon Society's Pacific Coast Convention, also in Asilomar, March 25-28, and at the Seventh Biennial Wilderness Conference in San Francisco, April 7 and 8. The announced theme of the Audubon meeting is "From Tundra to Tropics," and of the Wilderness Conference, "The American Heritage of Wilderness." But it is clear that all of these gatherings will emphasize the urgency of the threat to our natural resources and natural beauty imposed by the rapid growth of population and by other aspects of contemporary civilization.

Conservation Week, originated by the California Conservation Council, has been observed every year since 1934. It is not quite like the caucus race in "Alice in Wonderland," in which everybody started running when he felt like it and quit when he got tired; but because the dates—March 7-14—remain fixed from year to year, it *can* start on any day of the week. This year it starts on Tuesday.

The convenient system of the fixed dates is due partly to the good judgment of Miss Pearl Chase of Santa Barbara, who founded the California Conservation Council; partly to the California Legislature; and partly to Luther Burbank, who probably didn't know he had anything to do with it whatever. Miss Chase reasoned that if you changed the dates of Conservation Week from year to year nobody could remember them; but if you always had the same dates they would become fixed in the public consciousness. She found a convenient starting point in the fact that the California Legislature had set March 7 as Bird and Arbor Day. The reason the Legislature had chosen this date is that it was Luther Burbank's birthday.

Since most people do not know about this, it may be worth-while to recount the circumstances. In 1909 the California Legislature passed an act setting aside Bird and Arbor Day, and six years later the name was changed to Conservation, Bird and Arbor Day. The amended act reads:

### CALIFORNIA EDUCATION CODE

Section 5205 (originally 1909 California Statutes, chapter 82)

*Conservation, Bird, and Arbor Day.* March 7th of each year, the anniversary of the birthday of Luther Burbank, is set apart and designated Conservation, Bird, and Arbor Day.

All public schools and educational institutions shall observe Conservation, Bird, and Arbor Day not as a holiday, but by including in the school work of the day, suitable exercises having for their object instruction as to the economic value of birds and trees, and the promotion of a spirit of protection toward them, and as to the economic value of natural resources, and the desirability of their conservation.

It would be interesting to know who proposed this legislation—who moved and who seconded, whether it was referred to committee, whether there was any debate. But of all this, history sayeth naught. We have only the record of the action taken.

But it is interesting that, more than half a century ago, farsighted legislators saw the need of conservation education. At that time there were only two million inhabitants of the State, and its open spaces and natural resources must have seemed well-nigh inexhaustible. Today, with a population of more than fifteen million, and growing at the rate of 10,000 a week, California faces an entirely different situation.

With greater need than ever for food, its fertile fields, its fruit orchards and its orange groves are being overrun by subdivisions. With greater need than ever for wide open spaces, its wilderness areas are being invaded by helicopter, by jeep, and most recently by a modified version of the motor scooter that will run up mountain trails carrying people who are too lazy to walk with a pack on their shoulders. With greater need than ever to conserve what remains of natural beauty, its scenic areas are being scarred by freeways or marred by building projects. In the very regions earmarked for national parks or national seashores a race is on to deface the landscape before Congress can act.

Even as we write these lines, the bulldozers are at work. As Allen Morgan has sadly but truly said, "What we save in the next few years is all that will ever be saved." Conservation can't wait! R.C.M.

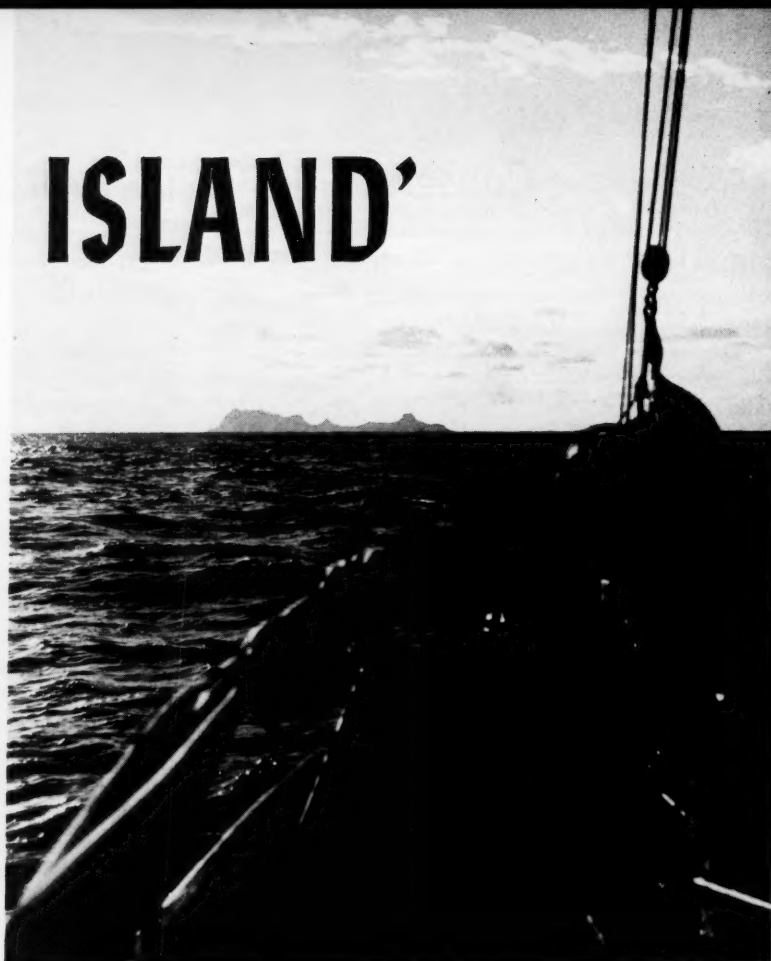
Ra'ivavae—

# 'HIGH ISLAND'

DONALD MARSHALL

*Pacific Discovery* is proud to present here the major part of Chapter 2, "High Island," of Donald Marshall's new book, *Ra'ivavae*, through the courtesy of Doubleday & Company, Inc., Garden City, New York, and the author, who supplied additional photos and the drawing. (Copyright 1961 by Donald Marshall)

The *Mareva* approaches Ra'ivavae.  
(Photographs by the author)



AS THE *Mareva* moved around the northern peninsula of Ra'ivavae and coasted under the peak of Mount Hiro, I caught my first glimpse of the village of Anatonu, in the shape of a large white church. This introduction was an appropriate one, for the church was the reason for the village's existence. During the pre-European period people lived in small thatched houses within the borders of the family planting lands. Today, they still maintain the pandanus plantation house, as a place to rest during the heat of the day, or even to sleep in for several days on end if their taro patch is some distance from the village. But the main life and hopes of the family centered in the town, for everyone wants to be near the church and take part in its continual round of services. With the money from a good coffee crop, the families take pride in improving their iron-roofed limestone or frame houses, purchasing the windows, doors, mirrors, beds, and heavy, closet-like *armoires* from Tahiti.

Anatonu means "cave of the giant fish." It is the name of both the village and the district around it, but no one could tell us exactly why such a name had been given. Of the four villages of the island Anatonu was the most vigorous and densely populated, although it

was part of the least fertile section of Ra'ivavae, lacking the rich valleys, extensive taro fields, and more plentiful waters of the others. As we neared the shore we could see ahead of us the scattered reef islets to the east. On our right, to the south, the mountainous backbone of Ra'ivavae stretched out in a long line of vertical cliffs and steep talus slopes; the houses, the fertile taro fields, the streams and fields, all lay on a narrow strip of coastal land which was hidden behind the young ironwood, or *toa*, trees which fringed the shore.

\* \* \*

Before I settled down to the hard business of immersing myself in the ways of High Island, I wanted to have a panoramic look at my new home. True, I had studied the few available maps of the island. There was one which Alan Seabrook had drawn with meticulous care when he worked there with [Frank] Stimson. It was a beautifully precise affair on which the rivers, valleys, peaks, and temple sites had been carefully situated after a personal visit to each place. Then there was another which Henry Pambrun of the Bureau of Lands in Papeete had kindly furnished me. It was a detailed map of the land-holdings for Ra'iva-

➤ From the top of Mount Hiro we looked down on the village of Anatonu, across the lagoon to the largest of the *motu*, Tehau, and along the island's "backbone" ridge to the east, while our artist, Jim Scott of San Francisco, sketched the scene.



vae, a necessary aid, for every foot of land on the island, however sterile, is the property of some person or family. In fact, every piece of land is named. Yet these were not enough. They were good maps, but they told me nothing of the environment of earth and sky, of wind and water. They gave me no knowledge of the life-zones of the island. To learn about this I had to spend weeks strolling, trudging, and exploring. But first I wanted to see the island in one panoramic sweep and for this I had to climb to the top-most peak of Mount Hiro, the highest point on High Island. It is not much of a mountain by the standards of those who live on great continents, but a young Ra'ivavaean, overwhelmed by joy at seeing his homeland again, once chanted:

*Oh my mountain!  
—soaring to the domed skies above.  
From thy cloud-capped peaks the dotted lands,  
Rising above the ocean's rim, become visible;  
There beside thee falls thy mighty shadow  
Upon meadows blooming with high-climbing  
flowers of the gods.*

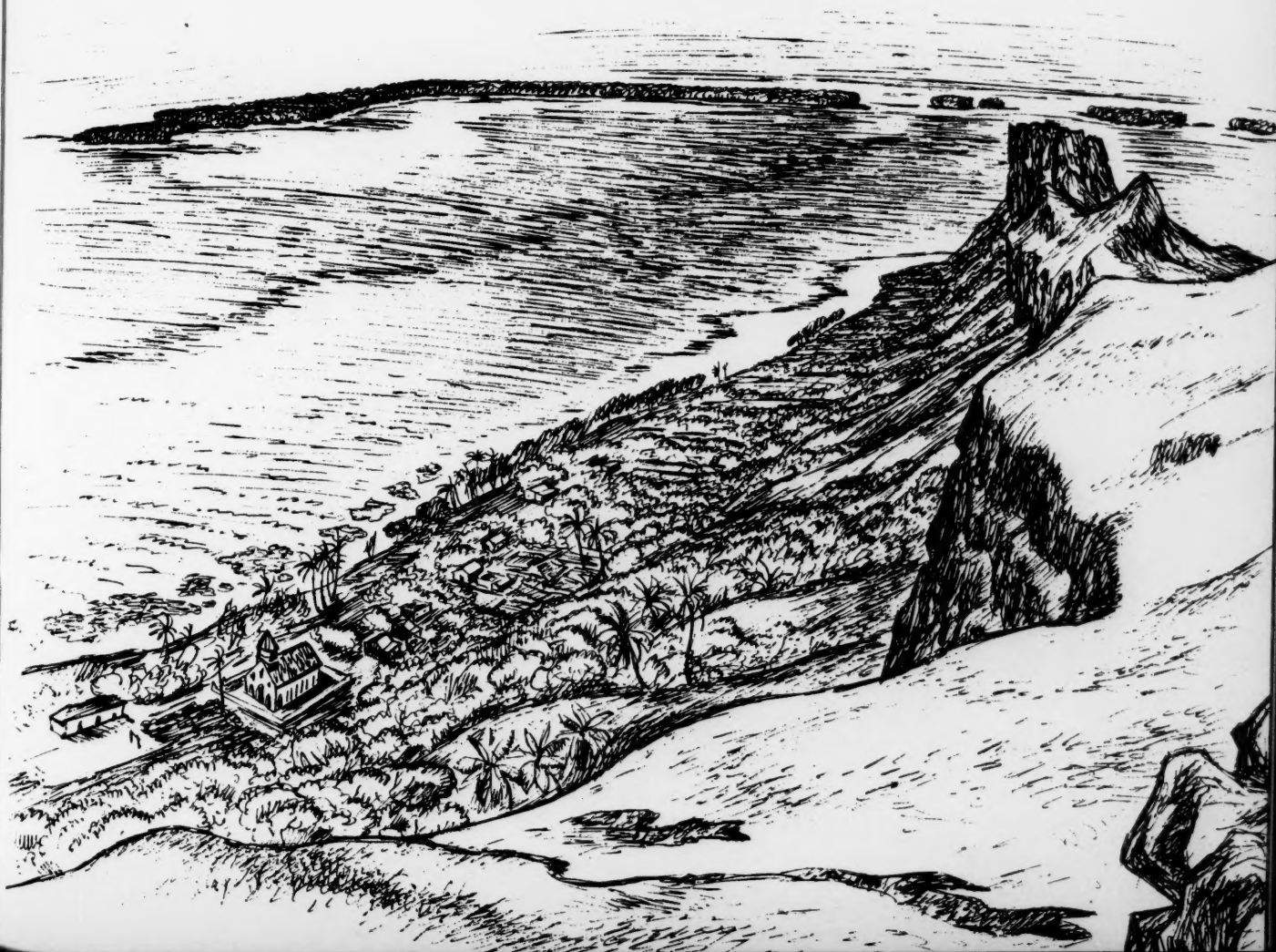
That was in another age. Nowadays, few native Ra'ivavaeans bother to make the arduous climb, and I had to turn to the friendly gendarme, Georges Arnaud, to

lead us up the mountain. Besides understanding just what kind of weather would ensure a dry enough terrain to make the climb possible, he knew of a path. . . .

The comparative ease of the first vertical climb was more than balanced once we began the delicate feat of moving up the razor-back ridge to the peak above. The sun had now risen and below there was a sweep of magnificent color: the deep-blue ocean, the white wash of the wave-smashed reef, the turquoise hues of the lagoon, the red earth of the eroded foothills, and the rich colors of the mountain flowers. The vertical northern face which we had just climbed differed markedly from the much gentler slope to the south. This had received most of the rain which fell from the predominantly southern winds and was covered to the rim with rich vegetation, huge tree ferns, guava bushes, and orange and candlenut trees. . . .

As we moved upward, many small flat goat stands and winding goat paths became noticeable, and we now could use the animals' trails to make our way. In places we moved along a ridge with precipitous drops only inches from each side of the slim trail. After a final breathtaking and difficult stretch we reached the pinnacle of Mount Hiro.

Below stretched Ra'ivavae—a small island only four



The chart is a greatly reduced portion of U.S. Navy H.O. 2228, with borders, scale-bar, and title positions changed to fit space.

and three-quarters miles long and no wider than a mile and three-quarters at most—a world in itself. To the east of our route the mountain peak sloped down to a great saddle-shaped plateau—a mountain meadow upon which escaped horses and bands of goats ranged. Running down in a direct line between Mount Hiro and the village of Anatonu, which lay far below us to the northeast, was a rush-filled ravine which ended in a small pond at the very brink of a precipice.

The contrast between the grass-covered meadows of the eastern half and the precipitous western ridges and cliffs is as great as that between the northern and southern sides of the dividing range. To the north the only vegetation other than grass and ferns seemed to be the miniature gnarled *Metrosideros* trees, with lovely red flowers whose spiked petals are tipped with gold. On the southern hills great blackened areas could be seen. These indicated that the islanders knew nothing of the disastrous effects of burning over the soil. To be sure, the French have made a law against this practice, but no one pays much attention to it.

But I was not interested in scenery alone. In one

sweep I could grasp something of the complex pattern of life which marks this island and relate it to the areas where each activity is carried on.

Encompassing all are the dark-blue waters of the Pacific. The ancestral knowledge of these ocean deeps, however, is known no longer to the present-day descendants of the Children of the Sea. This is the greatest and most poignant change that has come over Ra'ivavae. . . .

It is the barrier reef which provides the boundary which sets off the familiar from the strange. The work of myriad minute animals, this massive defense encircles the island a mile or so from the shore. The exterior slopes form a subterranean coral plateau which blunts the waves rolling in from far distant seas and protects the shallow waters and fertile shorelands within. Most of the wide reef is shallowly awash with the sea, but at irregular intervals some forty sand banks rise sufficiently high above the ocean to form atollons or islets. These are called *motu*. Most are covered with vegetation and for centuries have been a major economic asset. All are owned and the lots are



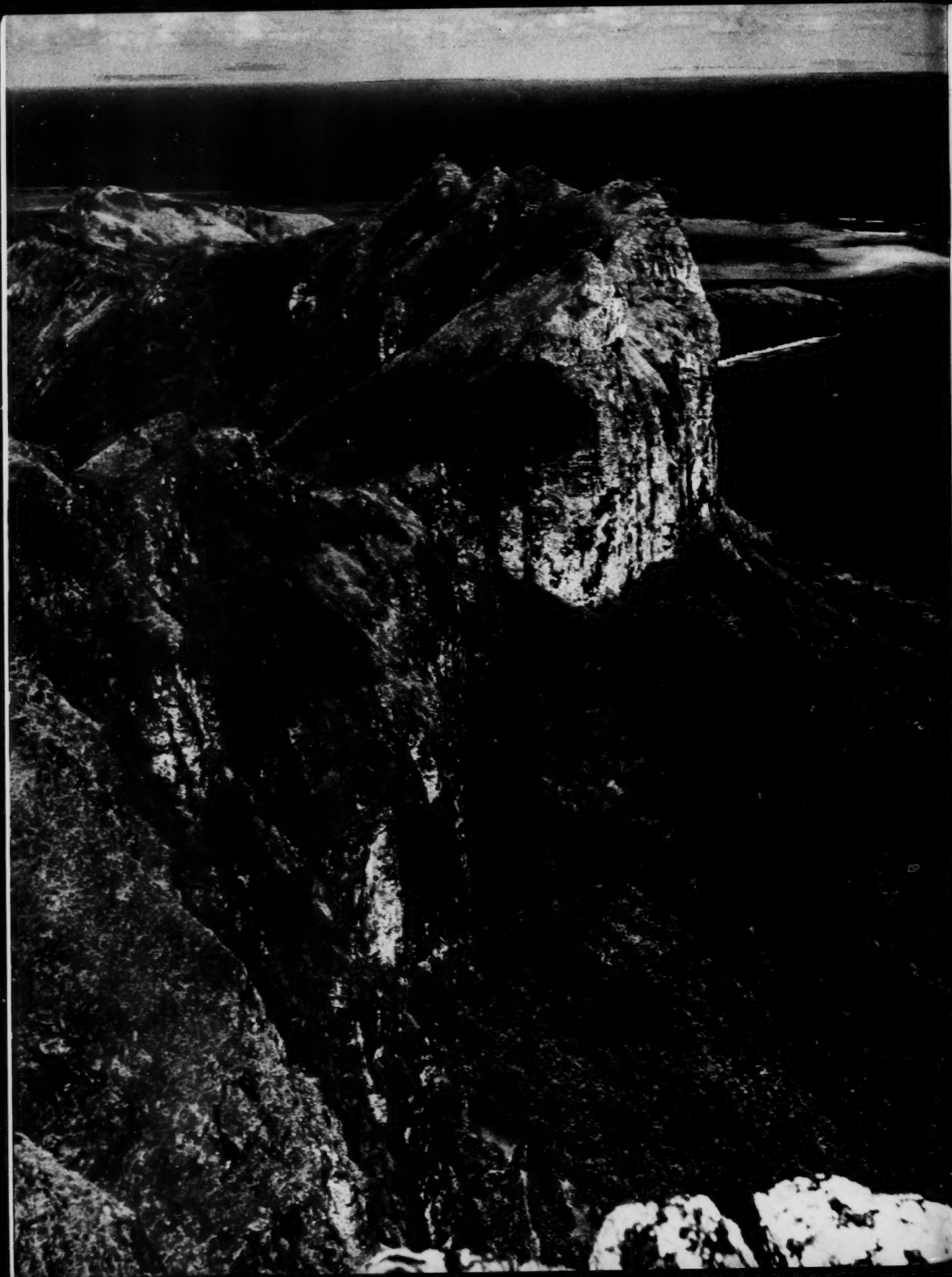
Once these reef islets were the site of pagan temples and houses. Now their only permanent inhabitants are the rats which live there in large numbers. But the islanders still visit them to collect pandanus leaves or coconuts, to search for marketable seashells, or to grill a few fish when en route home from their excursions into the lagoon. The Ra'ivavaean woman who otherwise seldom sets foot in a canoe occasionally sails out to gather shellfish or a special variety of the sea slug. There, the men seize great numbers of ocean crayfish for which Ra'ivavae is famous throughout the central islands. When the tide and sea are right one can easily walk from islet to islet along the reef, listening to the roar of the surf, the crashing breakers which cause a fine mist to hang in the air. Though the coral base is sharp and rugged, banks of pure-white sand extend far out into the lagoon. Two breaks in the reef, prob-

During our weeks on Ra'ivavae we were to make many visits to the lovely islets, looking for temples and habitation sites, trying to understand the economic cycle and varied life scenes of the people. We found that the clean white sand was actually composed of countless fragments of broken seashells, most of them bleached white by the sun. Surprisingly, this sand provides a rich soil for growing fine coconut trees, better than the poor ones which are to be found ashore. In all, the barrier reef was the equivalent of a full-scale atoll of the kind that make up such Polynesian island groups as the Tuamotus, the Northern Cooks, or the Tokelaus. This means that the few inhabitants of Ra'ivavae have economic assets which are usually found separately in other places. They can enjoy the advantages of a high, volcanic central land mass comparable to such islands as Tahiti. And they can reap the fruit of the barrier reef—the southernmost of Eastern Polynesia—the full equivalent to such atolls as Hao or Anaa.

The barrier reef also forms a deep lagoon between the *motu* and the fringing shore reef. The channel of

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the lagoon, though studded with huge coral heads, provides a passage through which a schooner can reach most of the island. Varying in depth, the lagoon offers a great variety of fish to the present-day High Islander without driving him to the danger of the deep seas.

Toward the shore is another reef, the very shallow fringing variety. The seaward face of it is higher than the shoreward surface. This keeps out the waves which form in the lagoon and provides a calm belt of water around the island. This is Ra'ivavae's chief avenue for getting from one place to another. Every part of the island is rapidly available by canoe transport. Heavy and bulky loads are easily carried in canoes, which are propelled by poling rather than by the more arduous labor of paddling. The shallow and sandy waters also provide needy widowed women, the aged, and the infirm with an endless supply of easily accessible shellfish and sea slugs.

At the heart of this series of concentric rings set in the broad Pacific is Ra'ivavae, less than eight square miles of bristling land. An easy morning's walk will bring one entirely around it, save for the precipitous western extremity, which lacks a path and must be visited by canoe. A range of mountain peaks splits the island in two from east to west, and, in turn, this jagged backbone is divided in the western part by mountains rising to the north and south. These heights form several relatively segregated lowland areas which slope to the sea and which were the natural bases for the boundaries between the independent districts into which the island was divided. The many rivers and the runoff from the mountains are the source of five great taro-growing areas. These are subdivided, in turn, into many smaller valleys by steep ridges which finger out from the major hills almost to the lagoon shores. Just off shore from the eastern tip of the island is the twin-peaked high islet Hotu Atua, whose bizarre shape is the subject of many numerous folk tales. Now it is a place where the islanders stop and rest after their trips into the lagoon.

Over the years, the narrow shore plain was formed by runoff from the steep hill slopes above coupled with a slight over-all emergence of the island from the sea. Nowadays this slender belt of land is the site of all habitation and of most economic activity. Once, great taro fields were scattered throughout the island, rising in man-made terraces well up into the hills. Now they are modest affairs handy to the needs of a more apathetic, greatly reduced population. Permanent homes are scattered along the inland side of the narrow path which parallels the shore of much of the island, but most tend to cluster near the churches and singing-houses which are centrally located in each of the four subdistricts of Ra'ivavae. The muddy, poorly kept trail with its shaky pole bridges spanning the small streams is mainly used for foot traffic or an occasional horseman. There is not a motor vehicle or even a wheeled car on Ra'ivavae.

Splendid as it is, seen at certain times, there is a depressing look to High Island. On both sides of the tawdry path there is a string of lime pits dug at inter-

vals of a few hundred yards. Lime is made by burning coral chunks from the lagoon together with huge quantities of wood. This produces a fire which is sufficiently hot to reduce the coral to pure lime. Over the years, these pits have consumed much of the rich vegetation which once covered Ra'ivavae.

Landward are great masses of hibiscus trees, used by the islanders for a variety of purposes, from fashioning bandages from its bark to interlacing its leaves to make blankets. But even these trees cannot redeem the air of neglect which seems to have overtaken that part of Ra'ivavae where people live and work. With the change from the old ways of growing taro in water to the modern "dry-land" cultivation, the finer points of island agriculture seem to have been forgotten. The streams, which now pour from the hills and form foul backwaters and malodorous pools, are used for both baths and laundry. How different from that fervent past when people chanted:

*Clasp—ever clasp us in thy lover's embrace,  
O Pool-reflecting-the-white-clouds!  
Thou whose cold waters are gazed upon each day  
by the young women.  
Thou art caressed by the chill fingers of the  
highland breeze,  
Wafted from the brow of the bold mountain  
named of old Ridged-crest-of-the-awakened-one,—  
A breeze heavy with the fragrance of kavaro flowers,  
Drifting,  
Drifting  
Drifting down  
into the pool reflecting the white clouds of the sky!*



Our daily bread: Pogi wraps a bundle of poi (the real Polynesian poi made of taro) in leaves for storage until next morning.

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The view westward from Mount Hiro gave us the sheer north face of 1,253-foot Mount Araua, beyond which Vaiannana Peninsula pointed towards tiny Motu Tuitui. The land slopes more gently toward the southern meadows and hills.

The loss of a sense of beauty, together with the degeneration of pride in order and cleanliness, have led to the replacement of order by disorder and of loveliness by ugliness. Even nature herself was affected by contact with the West. For with the whalers and missionaries came weeds and new flowering plants. And the ornamental plants, lovely in the domestic gardens of Europe, escaped from the cultivations of man to become monstrous weeds which turned the picturesque parkland valleys into tangled morasses.

In the foothills that rise up from the inhabited coastal strip there stand occasional banana plants, and here and there breadfruit, candlenut, chestnut, and banyan trees. But the ancient upland taro fields and the temple and assembly grounds of old are overgrown with the coffee tree, now the main economic mainstay of the island.

Beloved by Ra'ivavaeans for their beauty, the mountains have no economic value. Their steep ridges have been thrust up through fractured layers of both igneous and sedimentary rock, and the resulting caves serve as refuges when hurricane winds and high seas smack down the coconut trees, flood the taro beds, and flatten the frail houses. Once, splintery outcrops of the volcanic uplift provided ready-made phallic uprights for the temples and slabs for the altar walls. White layers of sedimentary coral-sand rock, easily split into squares, were used in the decoration of the marae and now make excellent building blocks for home or church. The talus slopes of mountain debris support a few guava bushes, and though coconut trees sprout from the crevices in the face of the cliff, their fruit is contemptibly small and lies rotting and unused at the bole of the trees.

Bands of wild goats ranged on the grassy plateaus and saddle-like tops of the mountain ridges which spread out below us. Before their ancestors were forced to these heights there was more forest land and a higher water table than at present. But years of grazing wiped away the cover, and where once the verdure-clad mountaintops held the excess rainwater, now it runs off in torrents during a storm—lost to nature and man.

And just as the ancient vegetation had gone, so had the land birds. Not even the pesky European mynah bird, now a normal part of the wildlife in other Polynesian islands, disrupts the stillness of Ra'ivavae. Occasionally one of us would startle a blue heron into stately flight, and frequently, as we worked over the hills and ridges, a red and white tropic bird would soar around us.

The cold wind from the south whistled around us as Jim sketched, Georges watched for game, and I pondered. I was trying to visualize the difference between the ways of life of those Polynesians who lived on the high islands such as we were now exploring and those who lived on the sandy atolls similar to the barrier reef and *motu* which surrounded Ra'ivavae. I realized that despite the dramatic beauty of these mountains, despite the economic value of the stone for making adzes and altar walls, they had little if any greater cultural significance than did the central

lagoon of the low islands. For the mountains were barren and impeded communication, while the lagoon provided fish, shellfish, pearls, and pearl shell, and was a convenient ocean waterway. Although the valleys of high islands could support taro and breadfruit and provide a more constant source of water, dwellers in the low islands raised their essential Polynesian foods on the *motu* and dug wells for their water.

This brought me to the conclusion that the term "Children of the Sea" was more than a boastful self-appellation of the Polynesians. They are essentially a sea people, not a land people. Whether dwelling on the narrow strip of humus soil which encircles the mountainous cones of Ra'ivavae and Tahiti or living on the atolls of Anaa or Hikueru, the Polynesian is never more than a few yards from the sea. He either spends hours a day fishing in it, or imbibes it in the salt-water sauces which accompany his daily meals. He once sprinkled it on temple pavings to render them sacred; he still uses it to heal the newly super-incised penis of the adolescent boy and to cleanse and soothe the woman who has just given birth.

The sea is the most permeating element in Polynesian life. So important is it, I learned, that one does not seek the embrace of women before venturing upon its surface, or defile it by allowing a woman in new menses to pass over it. He who plans to fish over the reef is careful to abstain from relations with his wife the night before—and if a wife betrays the fisherman at sea, he will not be allowed any catch.

From these revelations I realized that in Ra'ivavae, despite the great beauty, despite the geographic complexity, we were dealing with a typically Polynesian culture. Certainly the local geographic condition had affected to some degree the way of life derived from the original Polynesian ancestors, but I knew that in making my analyses I could rely upon my knowledge of Polynesia and upon comparative material from other islands to aid me in comprehending the local way of life.

**Ra'ivavae: An Expedition to the Most Fascinating and Mysterious Island in Polynesia.** By Donald Marshall. Doubleday & Company, Inc., Garden City, New York. 1961. 301 pp., 26 photographs; line drawings; endpaper chart. \$4.95.

European man descended so devastatingly upon the Pacific islands that an incredibly short period of time saw the end of a way of life it had taken centuries to develop and spread over an enormous area of the globe. Imposition of the narrowest, most purblind puritanism upon the remnants spared by disease, slaving, and other benefits white men conferred upon once vigorously teeming island populations was the coup de grâce. So thorough was the brainwashing by some missionary types, the present generation in many places has lost even the memory of the pagan ways of the last one. Modern anthropologists working in Polynesia, Micronesia and Melanesia still wrestle with the central issue of origins; but increasingly they seek to tune in the lost chords of once vibrant pre-European living in all the rich variation it knew from island to island, group to group. Our romantic interest—doubtless owing a good deal to Hawaii—centers on Polynesians. Whence came they, and what manner of Paradise did they create on their far-flung islands? One of the least known, because remote, of these is Ra'ivavae of the Austral Group, south of Tahiti. An architect-turned-Polynesianist, J. Frank Stimson, began the probe of this high island's mysterious past. Fortunate in many ways was the choice of young Dr. Donald Stanley Marshall to take up the task

(Continued on page 31)



## Arizona-Sonora Desert

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# UNDERGROUND

A GOOD MUSEUM EXHIBIT is the direct result of imaginative genius plus keeping one's ear to the ground. The unique natural history tunnel exposition at the Arizona-Sonora Desert Museum fourteen miles west of Tucson is an inspired example. When the Desert Museum was five years old it was doing a magnificent job of interpreting the flora and fauna of the Sonoran

desert with its accent on living plants and animals of the region. There was still a big gap in interpretation. And this gap was felt perhaps most by the children who flock to the popular museum. By keeping his ear to the ground (in more ways than one!), William H. Carr, Director Emeritus of the museum, hit on the unusual tunnel idea.

### Annette R. & Hiram L. Parent

IT WOULD BE a blistering hot summer day on the desert with the sun beating down and with no sign of life from reptiles, mammals or insects. A junior visitor would ask one of the staff, "Where is all the wildlife we came to see?"

The standard reply would be, "Oh, most of the desert animals are nocturnal. They are sleeping underground to escape the heat. They'll come out tonight."

"Oh," would be the disappointed answer of the

youngster. And then wistfully, "Wouldn't it be fun to go underground to watch them?"

Bill Carr pricked up his ears and did a slow double take. Yes, he thought, wouldn't it be interesting to observe the activities of plants and animals in their natural environment beneath the surface?

After many hours of thinking of ways and means, he approached Arthur N. Pack, co-founder with himself of the Arizona-Sonora Desert Museum and also

President of the Charles Lathrop Pack Forestry Foundation. As Educational Director of the Pack Foundation, Carr outlined his idea of a tunnel sixty feet long with animal burrows on one side and plant roots on the other, thus giving the public the chance for the first time actually to see what wild creatures and plants *do* and how they behave in their subterranean habitat.

Arthur Pack caught the spark and gave Bill Carr the go-ahead signal—even though he questioned Carr's cost estimate of \$25,000.

Eighteen months later, the idea was a reality. There had been incredible difficulties, and true to Arthur Pack's skepticism the cost had been almost double the original estimate. But, as he said on October 26, 1957 when he turned the completed project over to the Arizona-Sonora Desert Museum from the Charles Lathrop Pack Forestry Foundation, "The tunnel is a symbol of the reverence of life, a humble bow to the mystery of creation." The money was well invested.

For as thousands flocked to peek into the hitherto private domiciles of badgers, porcupines, ferrets, prairie dogs, kit foxes, rattlesnakes, pack rats, mice, ringtail cats, bats, and bees and to study the root systems of grass, shrubs, trees, and cactus, they were the first to enjoy such an opportunity.

As Dr. Robert L. Nugent, Executive Vice-President of the University of Arizona, said in the opening ceremonies, life begins underground in roots and little creatures. By going below the surface to see them, one gets close to the spirit of life.

What does the visitor see? Wandering over the Desert Museum grounds, he comes unexpectedly

➤ Kurt and Tani Bahti, grandchildren of Arthur N. Pack, seem to intrigue the kit fox in his comfortable den behind "invisible" glass. (Ray Manley)



Simulated red rock and caliche, to the right, alluvial soil farther on, line the tunnel. Also to the right are the twenty-two animal dens, while plant exhibits are on the left. (Ray Manley)





Mrs. Thomas N. Bahti and her son Kurt are intrigued by the tunnel's prize exhibit, the bat cave. Only one of the inmates is visible here, clinging to the rear wall. (Ray Manley)

upon what looks like a mine entrance with heavy weathered doors southeast of the main buildings. Going inside, he walks down a curving ramp into increasing darkness. His first glimpse of life is the south wall with its 22 one- and two-story animal burrows with ledges, recesses, and storage areas—oblongish holes in roughhewn rock and sandy soil. Dim lights at floor level on the right side and buttons on the left are the only illumination other than a faint green glow at eye level straight ahead on the wall. On closer examination, the visitor sees that a swarm of bees is busily building a comb in the green light. Straining to see more clearly, he leans on the rail and—presto! a light goes on below the bees inside a red rock den of a ringtailed cat who looks up lazily. Simultaneously, a clear plastic label giving some brief facts about the animal is lit up.

The next series of ledges is occupied by several western diamondback rattlesnakes who rattle six

inches from the visitor's nose. The glass separating the tunnel corridor from its regular occupants is so clear with illumination *inside* the burrows that there is no reflection on the glass. The effect is that of no glass at all!

A busy pack rat in his tiny hole hungrily eats both his own food and that which he pilfers in true-to-form fashion from his desert porcupine neighbor above. His fellow pack rat has been shooed out of the burrow permanently—the present kleptomaniac occupant won't allow him beyond the entrance.

The spotted and striped skunks may very likely be sleeping, their white markings on black fur confusingly defying identification as they curl in balls. Skunks have always been considered unsatisfactory museumwise because of their daytime snoozing. Here, appropriately, they are just “doing what comes naturally!” The lordly badger sleeps soundly in his mass of loose fur, quite oblivious of his human observers.

Desert broom thrives in its exhibit shaft, while the periscope gives visitors below a view of its crown along with a look at its roots (Photo by Hiram L. Parent)



These first animals all utilize natural rock caves or crevices or old mine shafts for their underground hide-outs. Separating them from animals who customarily dig their own holes or who use those dug by others in sedimentary soil are the three bat exhibits—fruit-eating, vampire, and insect-eating. The central one with the fruit-eating bats is the star attraction of the tunnel—“a bat cave that is more like a cave than a real cave,” to quote Lewis Wayne Walker, Associate Director of the Arizona-Sonora Desert Museum and the originator of the bat cave idea. An unbiased vindication of this cave’s realistic and authentic appearance was the admiring comment from a visitor while the tunnel was still in its early stages of construction. The bat cave was the only completed project.

Said he in incredulous awe, “How did you find it?”

A dozen bats cling to the rear wall in characteristic upside-down fashion. Occasionally one or two fly restlessly among the stalactites and stalagmites. A moist stalactite drips water periodically into a pool full of blind cave fish.

Then come the ferrets which used to live in prairie dog villages and feed on their inmates. This group of gray furred creatures is constantly snooping about. One may be trying to sleep while another tries persistently to burrow under him.

The prairie dogs, formerly living in colonies of thousands and almost unknown in wild colonies today, are apt to be bundles of fur with indistinguishable heads and tails. As they often congregate sleepily in a rear

The first diorama on the plant or north side of the tunnel is this worm’s-eye view of four root types—taproot (mesquite), bulbous root (gourd), clump root (grass), and shallow root (saguaro). (Parent)



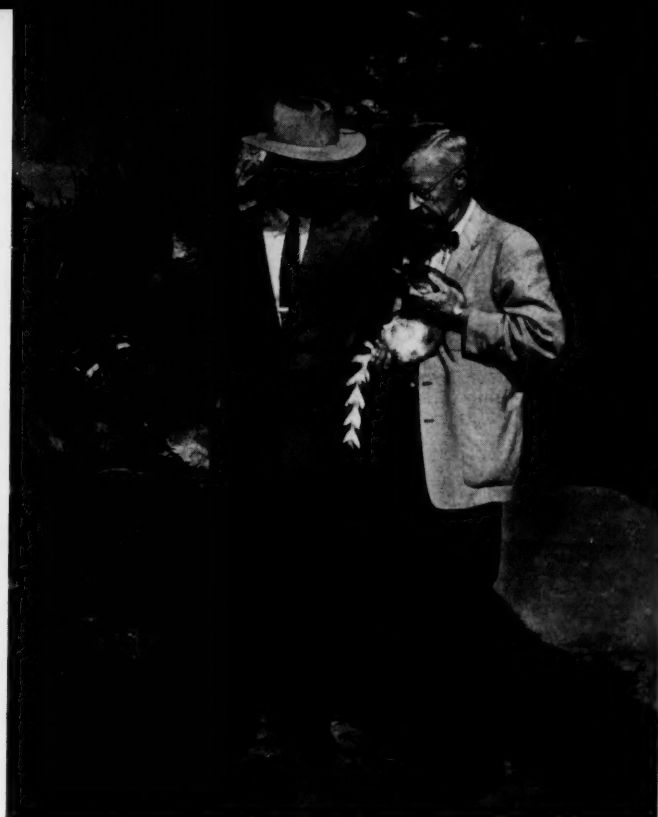
recess, very little is seen of them. By putting in a total of eight on opening day, the museum staff hoped that some would *have* to be out front on show.

Last and perhaps prettiest are the kit foxes who sit up in their den and survey their curious human callers in such an appealing way that one would like to pat them.

By the time the tunnel was officially opened, most of the animals had been living there for several months and were quite adjusted to their custom-made homes. But even so, one early visitor exclaimed indignantly at sight of their seemingly cramped quarters, "Why, the poor animals! . . ."

So, ears still to the ground, Bill Carr had a last-minute label inserted to relieve the minds of worried visitors: "All animals have outdoor exercise areas and can come and go as they please."

The two men who did the most to make the tunnel exposition a reality are William H. Carr and Arthur N. Pack, who is holding La Vaga, the ringtailed cat, at the entrance to the underground. (Parent)



While the animals are the initial attraction as the visitor sees them first, he soon crosses over to the other side to see what the root exhibit is all about. Two dioramas lead the display, the first with tap root, bulbous root, clump root, and shallow root as exemplified by mesquite, gourd, grass, and saguaro plants. The second shows the two purposes which roots serve: providing channels to the underground water table and making pockets which collect moisture and soil, thus preventing erosion. The incalculable power of root pressure in separating enormous rocks is stressed.

The two dioramas are followed by two windows with actual roots growing. By pressing a button, the visitor notes the roots in the soil pressed against the glass. And he studies the crowns above ground by peering through a periscope at the right of each window. Rarely can a person see both the roots of a plant reaching down for water and its crown stretching up for sunlight simultaneously. In succession, the visitor watches the growth processes of desert broom, mesquite, and creosote bush. A special exhibit demonstrates that although rodents are generally harmful to roots, there are beneficial factors of association. Root penetration creates fissures used for rodent tunnels, side rootlets support their chambers, and some of these pockets are used for food storage and placing seeds for future growth.

Further along the wall are the ant colony and the lightning exhibit. The former is a large, thick piece of transparent plastic tunneled and grooved in replica of the ant domain underground. It is dimly illumined to show the ants at work in tunnels and storerooms. They carry on life as in the wild, even to laying eggs and caring for them. The latter has on display a fulgarite, a glasslike material caused by lightning hitting the earth and fusing it. A small window simulates a view of a lightning storm as seen from an old mine tunnel. Pressing a button causes lightning to jump from clouds to a mountaintop in the miniature diorama.

When the visitor at last reluctantly walks up the exit ramp to daylight again, he is more aware of the world ordinarily beneath his feet.

As is invariably the case with a project that is well done, its construction appears deceptively simple. But if ever there was a museum enterprise which was characterized by experimentation, this was it. For from beginning to end, it presented an endless series of problems. Or, as Mervin Larson, Curator of Exhibits of the Desert Museum, who worked from the beginning with Lew Walker on the tunnel, puts it, "It was one long and continuous problem."

In the first place, the original trench had to be dug. It was 25 feet wide, 80 feet long, and 18 feet deep. Out of a hole large enough for six railroad boxcars came 1,300 cubic yards of earth. The main exhibit room was 60 feet long by 12 feet wide by 9 feet high.

The two ramps leading in and out added 98 feet, thus bringing the total distance from entrance to exit to 158 feet.

The overall construction was not a simple rectangular room with gently sloping ramps. There had to be exercise pits.


Instead of having obviously concrete walls with rectangular windows to the burrows, all was made to appear just as it would if you really *could* dig underground yourself; 22,500 pounds of casting plaster were used to achieve this effect. Painting latex on actual cliff walls in nearby arroyos and using this flexible cast, a 9 by 10-foot red rock cliff was reproduced to the minute detail—even to faithful color matching. The ringtailed cat's red rock den and the rattlesnake's caliche cavern are exact duplicates of real ones discovered not far away. The 10 by 10 by 12-foot bat cave, the tunnel's most ambitious project, was constructed with the help of photographs, notes, and casts made in Onyx Cave in the Santa Rita Mountains.

As the animal burrows were completed one by one, the question of how to present living roots in such a way that they would tell a real story remained unanswered until John Blydenstein, Dr. Herbert M. Hull, Dr. Tien Wei Yang, and Alan Blackburn went after the problem in earnest. Inserting the painstakingly excavated live roots of various plants along with soil down through seven feet of concrete-lined hole two feet square with great care, they pressed them against slanting glass. Periscopes enabled the person in the tunnel to see the plant above ground.

The ingredients of this superb natural history tunnel were time, patience, enthusiasm, imaginative genius, a generous financial grant, engineering know-how, conscientious labor and the helpfulness of countless persons. Symbolic of the spirit of coöperation which typified the whole project was the animals' own contribution on opening day: several baby mice were born in the tap-root exhibit!

There is usually a line of people going through on busy week ends, taking their turn at surveying the wonders of this underground world of plants and animals. Many stop to observe at their leisure the various facets of subterranean life.

As Mr. Carr says, "If in building our tunnel we have caught the imagination of children, helped someone forget worries as he walks through an unfamiliar, intriguing passageway with no daylight whatsoever; if we have given someone else ideas and prompted him to go and do likewise; if we have encouraged others to know more about the marvels of plant and animal life and thus appreciate them, then all the expense, time, and effort have been abundantly worthwhile."

A sojourn in this underground world is an unforgettable and enriching experience. 





# ST. HILARY'S GARDEN

Photo-story by ANNA-JEAN COLE

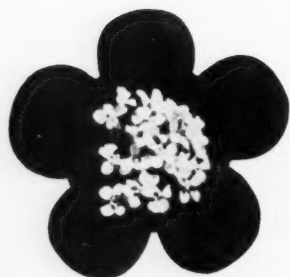
Among the first spring flowers, *Zigadenus fremontii* opens its dainty white stars in the brief green time of the dry grasslands.

ψ Among the rarities is Tiburon's own buckwheat, *Eriogonum caninum*. Developing a loose, spreading panicle of many small-flowered heads, it covers the dry hill with a rosy carpet in the late spring.

ACROSS the Golden Gate from San Francisco, in Marin County, on a little knoll looking down on Tiburon, stands one of the most picturesque chapels in California—old St. Hilary's. Although the chapel has been a favorite subject of countless photographers and artists, one of the outstanding properties of the entire knoll has been almost completely overlooked, and that is its wonderful inheritance of wild flowers. Many rare and beautiful plants are found in the sloping marshy strips or "fingers" below the chapel as well as in the dry, rocky grassland around it—one plant so rare it is found nowhere else in the world.



## ...TIBURON'S RARE WILDFLOWER TREASURY



The small white blossoms of the yarrow, *Achillea borealis*, make conspicuous clusters in late summer, close and flat at the top of tall flower stalks with finely dissected feathery leaves.

Rarer than Fremont's zigadene, *Zigadenus fontanus* is a summer blooming variety which thrives in the always wet "fingers," growing much taller than its cousin of the open fields.



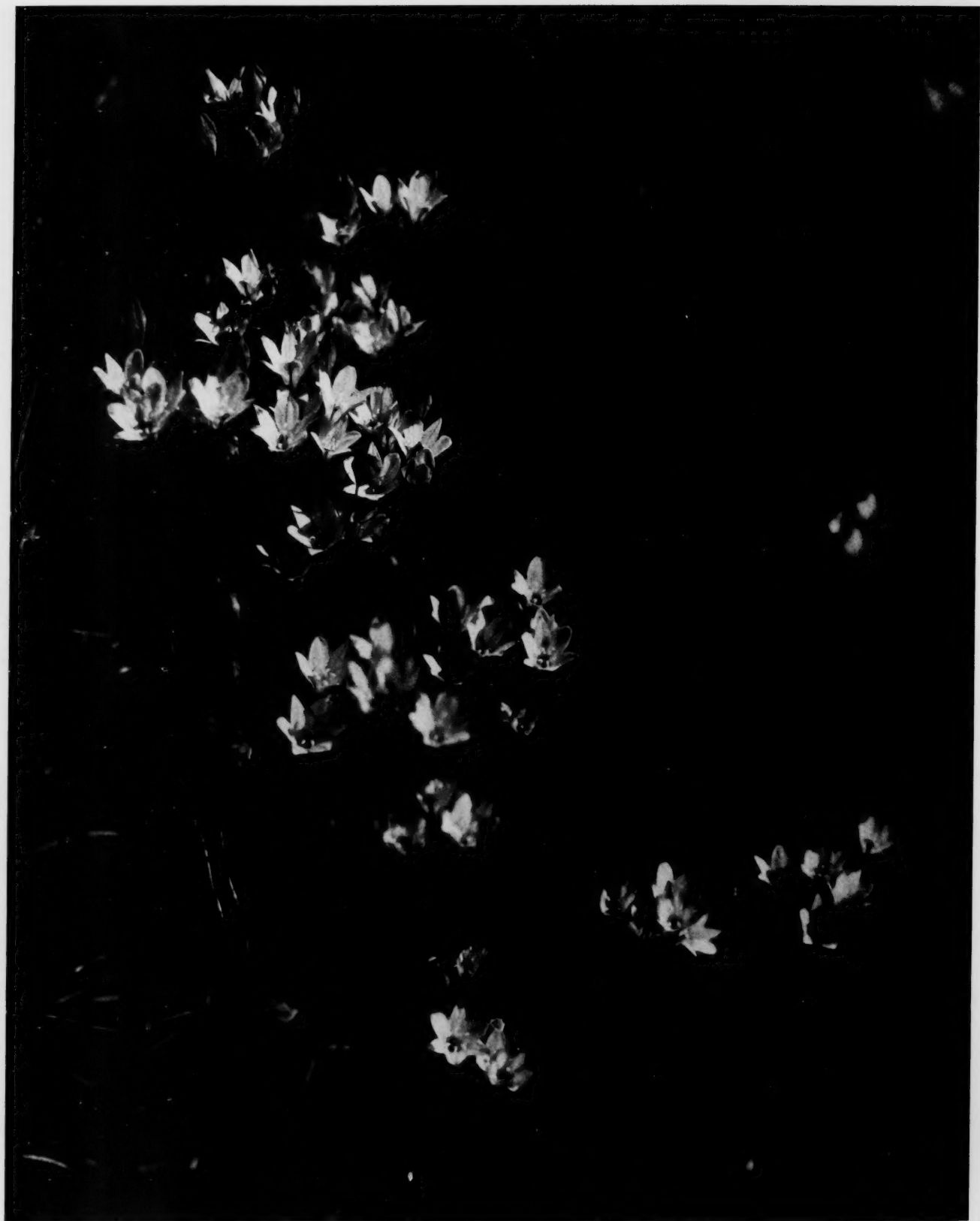
➤ There are two varieties of *Brodiaea* here, blooming a few weeks apart. This is *Brodiaea pulchella*, its straight slim stems carrying lovely blue blossoms in very showy clusters. Even more beautiful is *B. penduncularis* (next page).



California leopard lily, *Lilium pardalinum*, is one of the state's best known flowers. It loves "the rich soil of stream-banks or of wet, springy places" (Mary Elizabeth Parsons: *The Wild Flowers of California*).



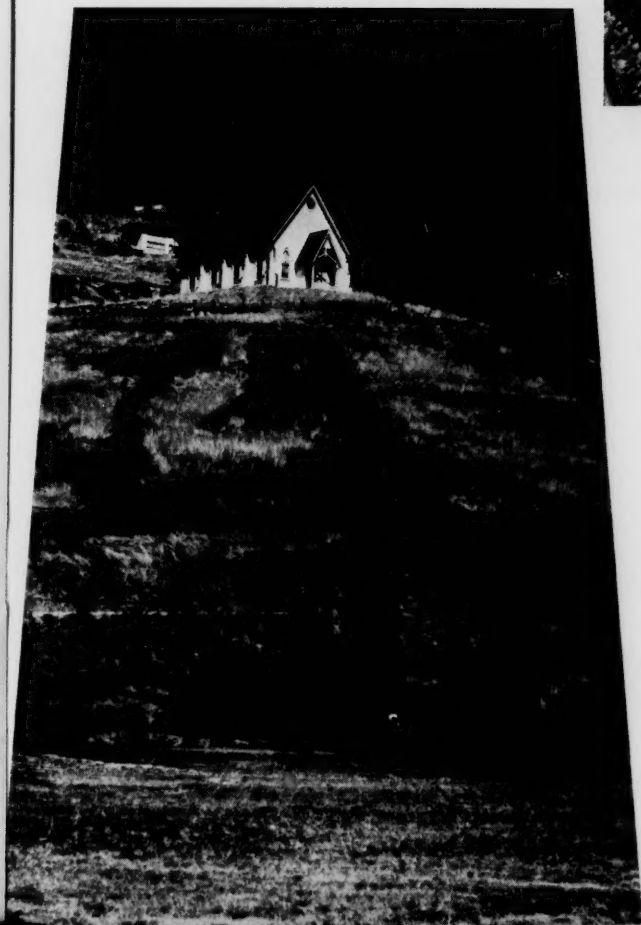
few weeks apart. ly blue blossoms iris (next page).



With its graceful habit and delicate flowers marked with greenish veins, *Brodiaea peduncularis* is one of the choicest things in St. Hilary's garden.



One of California's own hedge nettles, *Stachys pycnantha* is the last of Tiburon's wild flowers to make its annual appearance. Because of its coarse growth the plant has a weedy look. Although it belongs to the mint family it is quite different from the garden mint, its dense foliage having a strong, not too agreeable odor.



The California grass-of-Parnassus, *Parnassia californica*, is a clean-looking, brilliant white star of the marshy spots —the "fingers."



The chapel is built almost on a spring from which water seeps down over a concrete walk and then on down the marshy strips below which are known as the "fingers." When the hillsides are turning brown from the summer drought, the "fingers" brightly bloom with the interesting and uncommon plants growing in their shallows and along their marshy strand—a striking contrast. 27

# SUBANTARCTIC ISLAND



ALFRED M. BAILEY

ON THE DAYS THAT FOLLOWED our first exploring trip on Campbell Island, there were some fine moments of sunshine badly needed for photographic purposes, but the reports sent regularly from the island to Wellington for forecasting weather in New Zealand were of no help to us. We could tell conditions at the moment, but not what they would be in the next hour. The western skies were watched for breaks in the clouds that might indicate a few pleasant hours. Time after time we would hastily start up Beeman Hill directly back of camp, or begin the arduous climb to the summit of St. Col Peak only to be turned back by winds and overcast. Being constantly afield, our opportunities often came unexpectedly. A drizzly,

impossible morning might break at midday and give a few minutes of photographic light if we were prepared to take advantage of the opportunity.

We planned to visit the most out-of-the-way places first, so the tasks would be behind us. One of the *musts* was a visit to Courrejolles Point, a narrow peninsula jutting from the extreme northwestern corner of the island, for there on the almost inaccessible cliffs nested black-browed and gray-headed albatrosses, two species known to the whalers as mollymawks. We had seen the graceful birds curving like gliders behind the *Brough*, but only by a visit to their nesting ground could they be observed close at hand.

Doug Farmer had made the arduous trip to the

## PART II. (Part I appeared in *Pacific Discovery*, January-February 1961)

breeding colony some weeks before and he willingly agreed to show us the way. According to caliper measurement on the map, our destination was only about six miles as the crow flies—but how sadly disillusioned we were when finally on our way.

After five days of overcast and drizzling rain, January 16 broke with clearing skies. My grandson Jack, Artist Bill Traher, Doug, and I started off shortly after daybreak, heavily loaded as usual. We took the tractor trail to the old buildings at the head of Tucker Cove, and then started up a path cut by coastal observers where knee-deep holes were constantly throwing us off balance.

It was calm in the valley and clear skies with racing clouds overhead were encouraging. The air was filled with circling royal albatrosses, and when the crest of the ridge was reached we realized why. The wind on top was blowing more than forty miles an hour with occasional gusts that pushed us backward—ideal conditions for gliding sea birds but not for would-be photographers who had to climb one thousand feet more on the exposed seaward ridges to reach the summit of Mt. Azimuth. There was no chance to continue.

Our day was not lost, however, for in the lee of St. Col all was quiet, except for occasional stormy gusts. We followed along the 800-foot level dotted with nesting albatrosses and paid them brief social visits, lifting an occasional one to see if it wore a leg band, as this was the study area of naturalist J. H. Sorensen ten years previously. He had placed aluminum bands on the legs of many to learn something of the lives of individual birds.

Campbell Island is the main breeding ground of the southern subspecies of the royal albatross, *Diomedea epomophora epomophora*, rivaled in size only by the wandering albatross. Adult royals which we handled

weighed up to 22 pounds, and had wing spans of between ten and eleven feet.

On the exposed ridges, white against the skyline, were little groups going through "courtship" performances, gatherings described by whalers as "gams" or get-togethers. In the old days, when sailing ships sighted one another, sealers or whalers would get together to "have a gam," and the name has been applied to the actions of the various species of sea birds which assemble in a small area. The albatrosses had favorite windy spots on which to perform, places where the tussock and other vegetation had been tramped out through the years. Invariably these ritual spots were located where the birds could rise into the winds by merely running a few steps forward with outstretched wings and be airborne by the uplift.

Time and again we watched a flying albatross glide toward such a ridge and, with great webbed feet stretched in front, settle down as smoothly as a helicopter. Often the bird would stretch his wings, rise upon tiptoe, and, with extended head and beak, clap his mandibles together and give hoarse, far-reaching cries. Other cruising birds invariably came by, and one after another would drop down to accept the invitation of the first comer to join in a ceremony. As many as eight to ten albatrosses would gather, bowing and high-stepping around. The climax of an individual's efforts was when, with head and neck arched high, long wings thrust upward, he, or she, stepped proudly around, snapping mandibles loudly together and giving shrill calls.

Such a group paid no attention until we approached too closely, and then, looking foolish and acting like children caught in mischief, the great royals would pick their feet up high and shuffle away with bodies and heads almost parallel to the ground. One after an-

### PHOTOGRAPHS BY THE AUTHOR

A royal albatross (FACING PAGE)  
flaps his powerful wings, landing  
to join a "gam" (RIGHT), or group  
assembling for their "courtship"  
dance or ceremony.

*A possession of New Zealand,  
Campbell Island lies between  
the home islands and Antarctica.  
A detailed chart of the island  
appeared with Part I.*



other would stretch its wings, run clumsily, and rise like a glider.

On this day, Southwest Bay, with its conspicuous precipitous points and small islands dark against the light blue of white-capped waters, was particularly colorful. On the ridges of Mt. Lyall and eastward were spots of white which we knew to be performing albatrosses and down below was Tucker Cove with our headquarters a mile beyond at the head of glistening Perseverance Harbor. The air was so clear that we tried wide-angle pictures of albatrosses in the foreground, with the distant vistas in sharp focus.

The so-called "dance" of the albatrosses has always interested naturalists, and it has been only in recent years that some of the fascinating life history secrets of these wonderful birds have been discovered. Through banding, L. E. Richdale and Stanley Sharpe were able to study over a period of years the going and coming of individual birds.

Mr. Sharpe gave us a brief résumé of his experiences with nesting royals. Adults return in November every other year to the same areas where they nested previously. Eggs are laid, one to each pair, and both parents take turns incubating over a period of about eleven weeks. When the babies are hatched, they are carefully guarded by an adult for the first five weeks, after which the old ones fly out to sea, returning every three to five days to feed the young.

The juvenile plumage is well developed in approximately 33 weeks; a few young are able to fly two weeks later, and the majority have left their nesting island by the end of the 37th week—around mid-October.



After leaving their hatching places, young albatrosses wander the seas, traveling three thousand or more miles away, and then—after an absence of six years—return to their home island for a very brief stay. The seventh year they may make three or four visits; the eighth year they spend considerable time on the island where they were hatched. They join in the excitement of "gams," and it is probable that the majority of birds which we photographed in their "courtship" antics were eight years of age or older. The ninth year they return, possibly already mated, and nest for the first time—truly an amazing sequence of events.

Eight generations of non-nesting albatrosses are at sea, so if a catastrophe should happen to an entire breeding population, other generations would return to the home islands to perpetuate their kind. While there have been no comparable life history studies of other species, the same general sequence may be followed by other albatrosses, and on at least one occasion the staggering of generations has resulted in the saving of a species from extinction. For several years the short-tailed albatrosses, which nested on rugged islands off the coast of Japan, were thought to be extinct; then two years ago several pairs, undoubtedly a generation that had been roaming the North Pacific for the customary number of years, returned to nest. Now the islands are carefully guarded, we hope, by the Japanese government.

Our visit with the royal albatrosses was followed by two weeks of overcast and of continuous humidity in excess of 90 per cent, dull days which we put to good use in nearby areas. Back of camp was Beeman Hill, rising abruptly over 600 feet. On a bit of its sheltered cliff were two nests of sooty albatrosses, beautiful and gentle sea birds which do not occur in colonies, although occasionally several pairs may build their mud nests close together. The single egg in each nest had hatched about the time of our arrival and Met Observer Eric Clague had adopted the two young ones with the intention of weighing them once a week. Jack and I joined Eric on a trip to the nests when the young were just a week old, a nice climb through ferns and tussock. A pair of sooties were cruising about the summit of Beeman, keeping in perfect unison as they skimmed along like gliders, swerving to take advantage of the air currents. En route, at least 400 feet above the sea, we met an old female sea lion with her cub. She promptly charged, causing some excitement as we hastened to get out of her way.

The nesting site was sheltered, and faced east with a wonderful view down Perseverance Harbor. The parents made little protest as Eric took the young one from each nest and placed it on the scales, the week-old babies weighing one pound each. When Jack offered sardines to a brooding bird, she (or he) daintily picked one out of the can and, apparently not liking the taste, flipped it aside; then, reaching in again, took

Jack Murphy, the author's 15-year-old grandson (holding a royal albatross chick here), took the photos opposite, which are among the most important, scientifically, ever taken of a sooty albatross: (LEFT) feeding the young; (RIGHT) showing a leg band, which put the adult bird's age at 17 years.



another and again discarded it. After all, the sooty albatrosses feed upon squid, and our preserved fish probably made a poor substitute.

As with all albatrosses, the young sooties were guarded for a period of weeks and then were left by their parents for days at a time, the adults returning only to feed their babies. While bad weather prevailed, Jack tried to catch up with school assignments, working on reports which he planned to send back from New Zealand. He found a sheltered part of a cliff alongside the albatrosses' nests an ideal spot in which to study his lessons, and at the same time keep watch for a returning parent.

It is not difficult to take feeding pictures of albatrosses nesting in colonies, even though the individual adult may come back only every two or three days. With so many young available, a few old birds would be present at any given time, but with the sooty albatross, where only one or two pairs nest in the same vicinity, long waits may be expected. This would explain why few, if any, feeding pictures of the species had been taken.

Jack's vigil paid unexpected dividends for he not only got photographs of a sooty feeding a baby, but he discovered the adult had been banded. His pictures show the ring in place, and what was more important, the old one obligingly allowed the number to be read. It was A23 and had been placed by J. H. Sorensen on the leg of the bird as it was nesting on the very same ledge 11 years previously! As the albatross was an adult when banded in the 1947-48 season, it must have been six years of age, at least, and so was several years older than the young photographer.

*These pictures made by a 15-year-old boy may well be considered among the most important ever taken of a sooty albatross for, in addition to serving as feed-*

*ing records, they established the fact that individuals of the species reach an age of at least 17 years.*

After days of continuous overcast there came a rise in the barometer, and Alf Flahive announced chances for photography looked good on the morrow. An expedition was planned immediately to the mollymawk colony, and a call was made for volunteers to help carry gear on the trek of 10 miles or more that included a 1,600-foot climb over Mt. Azimuth, and a continuous up-and-down journey along serrated ridges dropping abruptly to the rugged coast.

Everyone wanted to go, so equipment was packed and an early start was arranged. There seemed no difference in the weather the following morning but the Met observer said a change was due, so all five from the Museum hit the trail at six-thirty, pleased that the island men would come later with additional loads. A small tent was carried so several could have shelter for a night or two, while the younger members expected to make the arduous round trip in one day.

Clouds hung low over the saddle between St. Col Peak and Mt. Lyall; Mt. Azimuth to the north which had to be climbed was obscured in fog. We slogged along as rapidly as possible, and in an hour were on the sea ridges where a southeast mist-laden wind was so strong it literally blew us up the mountain. Beginning to have some serious doubts about the weather forecasting ability of our meteorologist, we finally took refuge behind cliffs where there was some respite from the wind, and watched anxiously below for the first of the station personnel with our equipment. After freezing, wet to the skin, for what seemed like hours, we saw the New Zealand naturalist Bob Street and Kaj Westerskov slowly emerge from the mist.

The summit of Mt. Azimuth was in a dense cloud. We had a miserable lunch, crouching in the lee of jutting ledges, and debated whether we should turn back



or continue. No one felt like retracing steps, so keeping carefully to the sharp seaward ridges, bracing ourselves against sudden gusts, we worked up and down through tussock and fern. Occasionally bands of wild domestic sheep were seen, and sometimes skuas, which must have had young hidden nearby, would dive-bomb us. The cries of thousands of penguins could be heard, at the base of the cliffs, but the quaint sea birds were hidden in the mist rolling from below.

After six hours of heavy going, we finally reached the northwest tip of the island where a narrow peninsula juts into the Southern Ocean, with cliffs so steep that they would be inaccessible except by means of ropes. On all the narrow shelves, dimly seen in the swirling mist, were nesting gray-headed and black-browed albatrosses, usually referred to as mollymawks. We were able to descend to a few of the ledges and to have a close-up view of adults and the large downy young sitting bolt upright in mud nests green with lichens. While the two species tended to group themselves into separate colonies, there was no class distinction. Even with some overlapping of colonial territories all was peaceful, and harmony seemed to prevail.

A month earlier there would have been thousands of adults, concentrated on the ledges, incubating eggs, but now most of the young were four weeks of age and no longer needed protection from the predaceous skuas. Consequently, the majority of the old ones were at sea, and they would return, according to albatross custom, only to feed their young. A few babies were still so small that they needed brooding, and there were little bands of albatrosses just sitting about in groups—possibly “unemployed birds” getting acquainted—that would return the next year to mate and nest.

The gray-headed (*Diomedea chrysostoma*), with its conspicuously yellow-streaked mandible, is one of the most beautiful of all the smaller albatrosses. The action of the adults of both species seemed similar, pairs perched on empty nests going through head-weaving rituals with tail feathers spread.

We worked on the misty, windy ledges until the light was gone and then backtracked to the only sheltered spot noted on the entire trip where there was enough space upon which to erect the shelter tent. A few specimens had been collected for exhibition in the large habitat groups planned for the Denver Museum. As dusk was settling Bob Street, Putnam, Traher, and Jackie, heavily loaded, started the return trip. Visibility was about fifty feet, and I requested that the 15-year-old boy be stationed between Street and Putnam, while Bill Traher, an experienced mountaineer, brought up the rear.

The journey proved a difficult and somewhat hazardous one. The men were in a dense cloud, with drizzling rain, and were buffeted by a 40-mile wind. On the summit of Mt. Azimuth, they became separated.

Traher succeeded in reaching camp by ten, but the other three followed a foggy ridge to the left and did not realize for some time that they were off the track. The clouds hid all landmarks; the constant stumbling in the darkness was exhausting for they had been on the trail for many hours, and every time there was a pause for rest Jackie would go sound asleep. At midnight, they were back on the saddle between St. Col and Lyall Peak where gunshots were heard from the mist below. The entire personnel of the camp was out and on the way upward to give help if needed. There was no injury to anyone but it was a tiring trip, for all had been on their feet for 17 hours.

Eric Clague was the only one from the station who attempted to join us at the mollymawk colony. The others, wise men that they were, looked out the window—and returned to bed. Eric, heavily loaded with my strobe equipment, had reached the top of Mt. Azimuth, followed a wrong ridge in the clouds and spent a futile day trying to find his way. He returned to camp long after dark.

Those of us who remained in the shelter tent had an enjoyable time trying to keep it from blowing away. At eight the following morning, the light was strong enough to give visibility for 100 yards, and as I stood in front of the tent counting skuas that had assembled looking for scraps, out of the fog came lanky Geoff Thompson, his six-foot-four frame utterly soaked. He carried food and film which he thought he would use. His long legs had taken him over the very difficult terrain in three hours—the same journey had taken us twice the time.

The mist was heavier than on the preceding afternoon, but we returned to the ledges and spent the entire morning along slippery slopes, hoping for a break in the weather. The winds became stronger and the light poorer, but it was an enjoyable experience, nevertheless, for we realized that few people have been privileged to visit nesting colonies of these small albatrosses. Westerskov, Geoff Thompson, and Wichers banded many adults and young, and I took pictures. Old birds heavily laden with food came in from the sea to feed their young, and both species paid little attention as I crawled near and tried to record their actions. A parent would stand alongside the lichen-grown nesting mound, and the fuzzy baby with wheezy cries would stroke the parent's bill to induce it to disgorge. Finally when the mandibles of the adult were opened over those of the young, the oily, almost liquid food was drained over and into the beak of the eager baby. Feeding completed, the old albatross merely opened its wings, dived into the wind, and curved away into the fog.

By two in the afternoon it was evident that there was little hope of out-waiting the weather. There had been 11 days of continuous overcast and, except for Alf's hopeful prognostication, there was no reason to

believe there would be an early break. The tent was rolled and left in a little cave, as it could be used for shelter on another occasion, and we started off into the mist with most of my gear loaded on Geoff's brawny shoulders. Fortunately, the wind had changed to westerly, so again we were blown up the mountain-side. The summit of Mt. Azimuth was obscured, and we worked through the dripping tussock and across patches of slippery bulbinella, keeping to the seaward ridge where white lines of surf far below pounded against the steep walls. One foot was put past the

other for five continuous hours. On this descent from the summit of Azimuth, the gusts were of such gale proportions that it was necessary to lean into the wind; often when a blast hit, heavily laden as we were, we dropped to the ground to keep from being blown away. When camp was reached, we were told that the winds had reached a maximum of 70 miles an hour. While the other members of the party took the experience in stride, I realized that I had visited Campbell Island about thirty years too late!

*(To be concluded)*

Colony of  
black-browed  
albatrosses  
on the steep  
and narrow  
rocky neck of  
Courrejolles  
Point on the  
northwest  
side of wild  
Campbell  
Island.



## FOCUS ON NATURE WITH

hence in *The Space Merchants* (Ballantine Books). This is a science fiction novel originally published in 1953 and recently reprinted. It is primarily a satire on the Madison Avenue sales elite who hold the world in virtual slavery through fantastic sales methods of which subliminal advertising is but a kindergarten technique. But of interest here is the background theme of conservation.

By that time in world history most of our naturally occurring resources had been used up. Unchecked erosion and stream pollution had made fresh water an extremely rare commodity. Food directly from plants and animals was almost unknown. Synthetics were the order of the day. The general public was quite content with its lot, except for a "dangerous fanatic" group called the "consies" (short for conservationists). They believed in such "ridiculous and futile things" as trying to grow trees again, clearing up the fouled waters of the streams and lakes, and other obviously "un-American" ideas. Farfetched? Perhaps so but you need only carry certain current trends on to their final conclusions and nothing seems too farfetched. In the book a group of "consies" finally escapes the wrath of the Madison Avenue-dominated government. They flee to Venus for a second chance at civilizing a world—hoping to avoid the mistakes that despoiled the Planet Earth.

It is doubtful that we will have a second chance outside of science fiction. What we do here on earth during the next ten to twenty years may well have a profound effect on the kind of world our grandchildren will be born into. This should be a sobering thought to those city, county, state, or federal officials who may by the stroke of a pen prevent or commit the almost immediate and irrevocable destruction of something nature has struggled to build for perhaps ten million years.

But in spite of the needless slashing of Monterey Pines to produce a barren freeway between Monterey and Carmel, and the partial destruction of one of the last extensive areas of native grassland in California at Point Reyes, the general picture is far from black. The climate for conservation objectives, both national and local, is better than it has been in some years. The outlook for the Wilderness Bill is now favorable. Many conservation aims seem close to realization.

I am happy to report that in the San Francisco Bay Region recent developments in regard to the new campus for Alameda State College, in the hills just southeast of Hayward are very heartening to conservation-minded naturalists. The new site of 365 acres, although less than half a mile from a major highway and adjacent to well-settled parts of Hayward, includes some rather wild and rugged terrain. A deep, wooded canyon, complete with stream, lies along the south and southeast boundaries of the campus.

The usual procedure in developing such a site would be to fill the canyon with dirt from the hilltops. Fortunately, this will not happen here. President Fred F. Harclerod has set aside this area for preservation in its present wild state as an outdoor science laboratory. Future Alameda State College classes in nature study, conservation, ecology, vertebrate zoology, and entomology will be able to carry on field study and research right on campus.

Through the generosity of conservationist C. M. Goethe, a fund has already been started to assist in the appropriate development of this natural area. And with the cooperation of Hayward rancher Andrew Garin, the adjoining area along the opposite side of the creek has also been made available for natural history studies. In the months to come I will report from time to time on the plants and animals of this wild part of the Alameda State College campus.



Answers to Desert Plants Quiz (turn the page upside-down):

H, by Arthur and Edgar Smith; all others by Gayle Pickwell)  
Cactus (5), J. Screw Bean Mesquite (8), (Photo credits: A, F, G,  
G, Our Lord's Candle (2), H, Joshua Tree (3), I, California Barrel  
D, Blue Palo Verde (9), E, Honey Mesquite (7), F, Saguaro (4),  
A, Century Plant (1), B, Smoke Tree (10), C, Jumping Cholla (6).



Views of the new campus site and property of Alameda State College, Hayward, California. The thriving, rapidly growing city on the Bayshore plain is fortunate to have this fine reservation of wild hill and canyon directly behind it. (A. C. Smith)

ONE MAY BE alternately pessimistic or optimistic about the current conservation scene. Recent ground-breaking for a subdivision at Drake's Bay in the heart of the proposed national seashore park is a serious blow to the hopes of all who want to see this area saved from the bulldozer. The attitude of those who see no reason for preserving such areas is enough to make one think that perhaps Frederik Pohl and C. M. Kornbluth came too close for comfort in depicting the earth several centuries

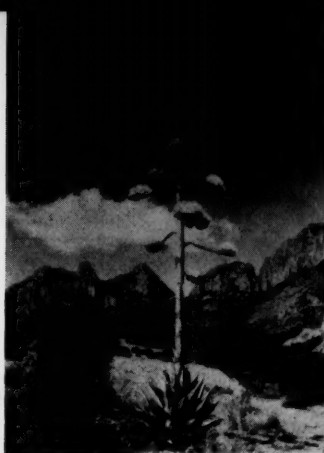


## Do You Know These Desert Plants?

TEST YOURSELF by matching the plants listed below with the photographs. Place the letter of each photograph in the appropriate space and then check the answers (upside-down on page 26). To learn more about these interesting plants of the desert see "Seven Trees of the Desert" by Lucile & Harold Weight and Ira L. Wiggins, *PD*, March-April 1956, pp. 4-21; "The Cacti-American Family" by Graham Heid, *PD*, July-August 1950, pp. 24-28; "Monument of the Joshuas" by Edmund C. Jaeger, *PD*, May-June 1955, pp. 10-21; "Save Our Saguaros!" by Weldon F. Heald, *PD*, March-April 1955, pp. 18-27; "Will Science Save the Saguaros?" by William A. Bardsley, *PD*, May-June 1957, pp. 24-29; and "A Giant and Its Cousins" by Ruth E. Kirk, *PD*, September-October 1953, pp. 6-11.

1. \_\_\_\_\_ Century Plant (*Agave* sp.)  
Range: Several species from southern California to Texas and in Florida. Many species in Mexico where they are the source of various fibers and fermented or distilled drinks. Flowers: irregular.
2. \_\_\_\_\_ Our Lord's Candle (*Yucca whipplei*)  
Range: Southern half of California, Baja California and Arizona. Flowers: April-May.
3. \_\_\_\_\_ Joshua Tree (*Yucca brevifolia*)  
Range: Southeastern California, Arizona, Nevada, and Utah. Flowers: April and May.
4. \_\_\_\_\_ Saguaro (*Cereus giganteus*)  
Range: Arizona, Sonora, Mexico and a few plants from the California side of the Colorado River. May be as much as 50 feet tall. Flowers: May-June.
5. \_\_\_\_\_ California Barrel Cactus (*Echinocactus acanthodes*)  
Range: Colorado and Mohave deserts in California to Utah and Arizona. Flowers: February-April.
6. \_\_\_\_\_ Jumping Cholla (*Opuntia Bigelovii*)  
Range: Colorado and Mohave deserts in California, southern Nevada, Arizona and Baja California. Flowers: April.
7. \_\_\_\_\_ Honey Mesquite (*Prosopis juliflora*)  
Range: Southern California to Kansas, Louisiana, Texas and Mexico. Flowers: April-June.
8. \_\_\_\_\_ Screw Bean Mesquite (*Prosopis pubescens*)  
Range: California, Nevada, Utah, Arizona, New Mexico, Texas and Mexico. Flowers: May-July.
9. \_\_\_\_\_ Blue Palo Verde (*Cercidium floridum*)  
Range: Southern California, western Arizona, Mexico. Flowers: March-April.
10. \_\_\_\_\_ Smoke Tree (*Dalea spinosa*)  
Range: Southern California, western Arizona, Mexico. Flowers: June-July.

A



B



C



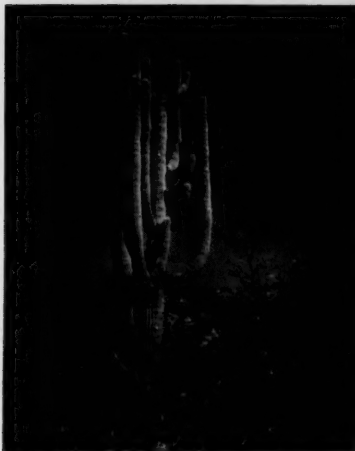
D



E



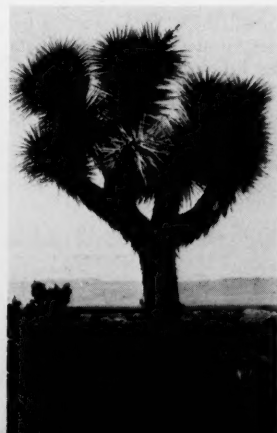
F



G



H



I



J



## How RED are the Stars?

CAREFUL INSPECTION of the numerous bright stars in the winter sky will reveal that there are considerable differences in their colors. These color differences are not generally obvious, but they are detectable. Some examples: Sirius, Rigel, and Castor are blue; Pollux, Capella, and Procyon are yellow; Betelgeuse and Aldebaran are red. Only in recent years has there been available suitable equipment for accurate measurement of the colors of stars, and this has become a very rewarding field of astronomy. This phase of the science had to wait for the development of the age of electronics.

The device in most common use for color measurements today is a *photoelectric photometer*, using a light sensitive tube of very high sensitivity and range called a *photomultiplier*. With this tube and its associated amplifier attached to a telescope, it is possible to obtain accurate measurements of the brightnesses of stars; and by the introduction of colored glass filters, the brightnesses in different colors of light may be obtained. By comparing the brightness of a star in blue and yellow light, a ratio is obtained which is equivalent to stating the color of the star. The ratio is related logarithmically and a number is obtained which is called the *color index*. For the very hottest stars, which are also the bluest, the index is  $-0.64$ , and for the reddest stars (the coolest), the index is  $+3.3$ . The larger the number, the redder is the face of the star.


But what is the point of determining the color of the light of a star? All the information we have regarding the physical nature of the stars is obtained from observation of the light they send us. They are too far away for access, but their light carries a wealth of clues. The unraveling of these clues to reveal their secrets is one of the most remarkable feats of detective work in the world of science. It is obvious and has already been mentioned that the color of a star is an indication of its temperature. Since the stars are huge balls of luminous gas, from the theory of gases at high temperature the luminosity of the surface of a star can be computed from its color. If we can determine its distance, then its surface brightness and its apparent brightness give us its size. Or, if we can determine its size by some other means, its surface brightness and its apparent brightness yield its distance. There are independent methods of obtaining the sizes of some stars and methods of determining distance for others, so if one is known the other can be determined from a measure of the color.

Further refinements of color measurement yield the detection of metal vapors in the atmosphere of a star. Its spectrum coupled with its color can reveal its mass, density, and chemical composition. From an analysis of all these data, we are even finding it possible to determine the ages of the stars and the order of their evolutionary processes.

While the color of a star is only one of a multitude of physical properties in which the astronomer is interested, the increased accuracy of color measurement over the last few years has been a valuable addition to the tools of the trade.

G.W.B.

ASTRONOMY



A small section of the sky in the constellation Sagittarius. The upper photo was made using blue light, the lower with red light. The bright star in the lower photo is a red star and appears much fainter in the blue-light photo. The red-light photo also shows many more stars. This is because of the ability of the red light to penetrate the haze of gas and dust filling the space between the stars. (Mount Wilson-Palomar Observatory photograph, from *Pictorial Astronomy* by Alter and Cleminshaw, Thomas Y. Crowell Company, New York, 1952; reproduced by permission)

Of a man and mountains

**Words of the Earth.** By Cedric Wright. Edited by Nancy Newhall. Foreword by Ansel Adams. Sierra Club, San Francisco. 1960. 95 pp., 54 photographs. \$12.50.

So splendidly conceived and executed a book as *This Is the American Earth*, widely and resoundingly heralded since its appearance one year ago, could not easily be surpassed. Yet, in this reviewer's opinion, the Sierra Club, publishers of both 10½x13½-inch graphic masterpieces, has done just that. Comparison of the two has little point, perhaps, except as one of departure. But one who dares call the newer one the greater, had best explain himself. He might start with some reverse French—*plus c'est la même chose, plus ça change*. He need not end up by reversing himself with respect to what he said editorially, last March-April issue (Pre-Discovery), in unqualified praise of the first book. *This is the American Earth* is itself an editorial statement, as imperative as it is artistic—and artful. It is what it sets out to be, in superlative degree. But as an editorial must be, it is contrived (and is therefore on some points vulnerable). This is where I say of *Words of the Earth*, *ça change*.

The late Cedric Wright was a photographer with peers but without masters in his favorite milieu, the mountain landscape. This fact gives poignance to the compelling tribute paid him in Foreword, here, by his friend of half a lifetime, Ansel Adams, himself with few peers and no masters in most branches of the photographic art and craft. What follows the Foreword is pure Cedric Wright and contrived only in that his tragic incapacitation and death (1959) left it up to an editor to put his words and his photographs together. Nancy Newhall has done this with the same feeling, insight, and artistry with which she and Ansel Adams put together *This is the American Earth*. That

is to say, it is inconceivable it could have been done better.

What of the philosophy of Cedric Wright on the evidence of this posthumous presentation of a little part of what he left behind on paper? For his many friends (I would like to have been more than merely acquainted with him) that is written for life in mind and heart. For the rest of the world, so far as it responds to such qualities, it speaks—Cedric Wright speaks—of valuing “qualities above what are usually considered meanings,” . . . of the “secret of fine results” which is “to enjoy the most luxurious deliberation in each step of the work,” . . . and especially of “the face of nature—that mysterious infinity: eternally a refuge, a reservoir, an amplifier of the spirit, a mother of dreams, a positive though elusive voice in whose depth lies its subtle power.”

Wright's Credo was lifted for the book from his article “Mountain Photography” (*Sierra Club Bulletin*, February 1941). It is to be found further in the bits and pieces of trailside and campfire jottings which Nancy Newhall has matched to the photographs here selected from the negative file he left to the Sierra Club—the counterpoint of sound to sight forming the ensemble of *Words of the Earth*. Thus, above a close view of stream tumbling white over granite: “There is mighty contagion in the qualities of things—primitive and authentic joy in closeness to vital running water, fire, wind.” Every page is quotable. One to leave open here, for contemplation—to an expanse of sunlit sea, nothing else (one of but five, in all, of non-Sierran pictures): “Out of the sea, in vast currents, a mystic essence arises—essence of the infinite godliness which creates worlds. A new astronomy of the spirit should become a conscious goal of man.”

If this is indeed the superior book, it is so, I find, in the sheer integrity of its simple directness as statement of the spirit of one very considerable artist, philosopher, and man. Cedric Wright was an astronomer of the spirit. D.G.K.

SKY DIARY

March, April, May, 1961

(All Times are PACIFIC STANDARD TIME)

Phases of the Moon

☉ Full Moon	March 2	5:35 A.M.
☾ Last Quarter	10	6:58 P.M.
☽ New Moon	16	10:51 A.M.
☾ First Quarter	24	6:49 P.M.
☉ Full Moon	31	9:48 P.M.
☾ Last Quarter	April 8	2:16 A.M.
☽ New Moon	14	9:38 P.M.
☾ First Quarter	22	1:50 P.M.
☉ Full Moon	30	10:41 A.M.
☾ Last Quarter	May 7	7:58 A.M.
☽ New Moon	14	8:55 A.M.
☾ First Quarter	22	8:19 A.M.
☉ Full Moon	30	8:34 P.M.

The Planets

**Mercury:** Will be too close to the sun to be seen in early March but by the 20th it will be at its greatest western elongation reaching a maximum of 28° west of the sun. It will then be rising about two hours ahead of the sun. Mercury will not be seen during April and early May, being again too close to the sun. It reaches superior conjunction on May 1. It can be seen low in the western sky after sunset by the end of May. Greatest eastern elongation of 23° occurs on June 1.

**Venus** remains a conspicuous object throughout March. Greatest brilliancy occurs on March 5 when it reaches a magnitude of -4.3. A pair of binoculars will then show Venus as a thin crescent,

about 20 per cent of its disk illuminated. Venus rapidly approaches the sun through March and by the first of April is lost in the solar glare. Inferior conjunction occurs on April 10. By mid-May, Venus will again be a prominent object but this time in the morning sky, reaching greatest brilliancy on May 16.

**Earth:** The first day of Spring begins on March 20 in the Northern Hemisphere while the Southern Hemisphere experiences its first day of Autumn. This announces the sun's arrival upon the celestial equator.

**Mars:** Throughout these three months, shrinks in size and decreases in brightness as the earth leaves it behind. Its motion is directly through Gemini in March but by the end of April it has entered Cancer and will remain there throughout May. By the end of May, Mars has diminished in brightness to +1.6.

**Jupiter:** Rises about two hours before the sun by the first of March. It passes from Sagittarius into Capricornus by mid-March and remains in that constellation through April and May. Jupiter passed about 0.2° south of Saturn in mid-February and will remain close to Saturn during these months. By the end of May, Jupiter can be seen rising about midnight and shining at magnitude -1.9.

**Saturn:** Can be seen rising with Jupiter during March. The ringed planet will be less than 7° away from Jupiter throughout the entire year. Even though Jupiter is slowly moving ahead of Saturn during these months, Saturn will be seen to rise about ½ hour before Jupiter by the end of May because of Jupiter's more southerly declination.

**Special Event:** On March 2, observers in North America will witness a partial eclipse of the moon. At maximum eclipse, the moon will be about 80 per cent covered by the umbra shadow of the earth. Below are the phases of the eclipse for the Pacific Coast:

Moon enters Umbra—3:51 A.M.  
Middle of Eclipse—5:26 A.M.  
Moon leaves Umbra—7:05 A.M.

O.R.N.



## Discovery of an island world

**The Discovery of the Pacific Islands.** By Andrew Sharp. Oxford: at the Clarendon Press (Oxford University Press, New York). 1960. xiv + 259 pp., 6 maps, 4 half-tone plates (of historic charts). \$7.20.

The two main general works available on Pacific discoverers, J. C. Beaglehole's *The Exploration of the Pacific* (London, 1934) and Sir Peter Buck's *Explorers of the Pacific* (Honolulu, 1953), still left room for a more comprehensive—and exhaustive—treatment of the European and American voyages of the Age of Discovery in the Pacific and an accounting of the islands discovered. Like Dr. Beaglehole a New Zealander, but somewhat differently qualified, Andrew Sharp has contributed two significant studies in this difficult and controversial field of inquiry: *Ancient Voyagers in the Pacific* (Polynesian Society, 1956; Penguin Books, 1957), and the present title. As its title suggests, his *Ancient Voyagers* chiefly looks into the Polynesian phase of Pacific exploration and island discovery—its thesis that pre-European voyages and landfalls were more accidental than otherwise—but carries this down to include the observations attributable to various island-native pilots or fortuitous guides of European ships to the time of Captain Cook. The later work deals with the great host of white navigators of the three and a half centuries from Magellan (1519) to the American Captain Brooks who nailed Midway Island to the chart in 1859. In 122 tight sections—often brief for sheer lack of sources—Sharp summarizes what is known of the various voyages, their courses, sightings, landings, evaluating and interpreting for the still partly tentative record. Ethnological observations are included wherever the sources give them. The work resulting from this method is, for reference, invaluable, for merely reading, indifferent. Part of one section is given here for example, selected for its pertinence to this issue of *Pacific Discovery*. It is numbered and titled "35. Domingo Boenechea and Tomas Gayangos." The voyages described went out from Callao, Peru, in 1772 and 1774 to the area of the Tuamotus and Tahiti. The report:

"After the death of Boenechea in Tahiti, Tomas Gayangos became commander of the expedition, and returned to South America in company with the store-ship. The ships got clear of the south of Tahiti on 30 January 1775, and took a course to the south-east, lying to at night. On 5 February 1775 they came to an island, the latitude given being 23° 30' S. The next day a boat was sent in, and made contact with the inhabitants at the shore edge, but a landing was not made. The people said that the name of their island was 'Oraibaba.' The Spaniards called it Santa Rosa."

### The interpretation and ethnological note:

"This island was Raivivae [Ra'ivavac], in the Austral Islands, same 360 miles south-south-east of Tahiti, in latitude 23° 52' S. "Andia, the commander of the store-ship, has recorded in his journal the report of Bonacorsi, the officer commanding the *Aguila's* boat which made contact with the islanders of Raivivae at the shore edge. The Tahitian interpreters who went with Bonacorsi could understand only an occasional word used by the islanders. The people were like those of Tahiti, some white, some mulatto-colored, some more swarthy. They were tall and of good physique. Their ears were pierced and their hair was fastened in a tuft on the head. Their clothing was of wraps like the Tahitian, in various colours. They had double canoes with high bows and sterns. Their weapons were well-made short pikes and short cudgels, but the people appeared peaceable. . . ."

The discovery of Campbell Island is dealt with in fewer lines. History has little to say about it.

Mr. Sharp has in any case made a much-needed addi-

tion to the too-small reference shelf of Pacific discovery. The book that is more complete than Beaglehole's, but equally readable, may some day be written. That this is not it is in itself no cause for criticism.

## The worth of wild lands

**The Meaning of Wilderness to Science: Proceedings, Sixth Biennial Wilderness Conference.** Principal contributors: Daniel B. Beard, Stanley A. Cain, Ian McTaggart Cowan, Raymond B. Cowles, Frank Fraser Darling, Luna B. Leopold, Robert Rausch, G. M. Trevelyan. Edited by David Brower. Sierra Club, San Francisco. 1960. xi + 129 pp., 40 photos, endpaper map. \$5.75.

With the long-awaited and hard-pressed Wilderness Bill now at last apparently coming up for action in the Congress, there could be no better time for members of the general public to seek information on the what and why of wild-land preservation. A few hundred—for the most part already convinced and ready-in-turn-to-spread-the-word souls—are fortunate enough to have been present at one or more, or all, of the six biennial wilderness conferences which the Sierra Club has mounted for public debate and enlightenment in Berkeley or San Francisco beginning in the spring of 1949. Taking up the theme explicit in the title of this book of its proceedings, the Sixth Biennial Wilderness Conference held in San Francisco in March 1959 bore down, more than any previous one, on issues affecting nearly everybody, whether they know it or not. The table of contents of *The Meaning of Wilderness to Science* is a catalog of major world concerns along with some areas of specific application (addresses to the Conference in order of authors as listed above): "Plants and Animals in Natural Communities," "Ecological Islands as Natural Laboratories," "Science and the Wilderness," "Population Pressure and Natural Resources," "Wilderness, Science, and Human Ecology," "Ecological Systems and the Water Resource," "The Outlook for Conservation in Alaska," "The Call and Claims of Natural Beauty" (the last an Appendix here, a lecture given in 1931 before the University College Medical School and Hospital, London). The seven addresses are followed by the discussion as transcribed at the Conference (both the addresses and the ensuing discussion were taped, and are presented here with a minimum of author-correction and editing). Review of all this material would make excellent preparation for both the Audubon Convention and the Seventh Biennial Wilderness Conference about to take place (see Editorial, page 1). Rausch's Alaska piece, for instance, would help ground the Audubon people for getting the most out of their theme "From Tundra to Tropics."

A word about the finely printed 48 pages of plates: One section consists of eight photographs by Ansel Adams entitled "Alaska, The Great Land." The other is "Wildlife and Alaska"—photographs by Warren Steenberg, Charles J. Ott, and Herb and Lois Crisler, with legends by Lowell Sumner.

It is most timely and salutary that the substance of the 1959 Wilderness Conference is available in book form at just this very critical present moment.

## Shall we waste the sea, too?

**The Sea Around Us.** By Rachel Carson. Revised Edition. Oxford University Press, New York. 1961. xviii + 237 pp., 16 half-tones, 2 charts, decorative endpapers. \$5.00.

The Atomic Age has made imperative what oceanographic developments of the past decade have made merely necessary—a revised edition of this most popular of books about the sea and man's relationship to it. Here again is the superb text, as it first appeared; but Miss Carson has added an appendix of notes on such



matters as most recent estimates of the age of the earth, the discoveries in the deepest depths made by the *Trieste*, Project Mohole, and the Global Thermostat. The imperative of this book is in Miss Carson's prefaced warning about disposal of atomic wastes in the sea. With the oceans having been for many years past pointed to as our last great reservoir of the necessities of human life on an overcrowded globe, here we are right now in the process of irrevocably poisoning the salt waters—and we do not actually know what the consequences of this practice will be. There are already serious danger signals. Before we carry this further, we should get a far more realistic idea where it will, or even might, lead us. Recommended reading for the AEC.

D.G.K.

### The Nature Trail

**Complete Field Guide to American Wildlife—East, Central and North:** covering all species of birds, mammals, reptiles, amphibians, food and game fishes, seashells, and the principal marine invertebrates occurring annually in North America east of the Rockies and north of the 37th parallel. By Henry Hill Collins, Jr. Harper & Brothers, Publishers, New York. 1959. xix + 683 pp., more than 2,000 illustrations and maps, over 700 species in full color. \$6.95.

If your interests are as broad as the subtitle above, if you live in that area, and if you have a fairly baggy pocket, this should be the book for you. A companion volume covering the northwestern sector of the continent would have to run from Alaska to the Sonoran Desert. It would take a third volume for the southeastern, south central, and Gulf states and the rest of Mexico. This would make a very impressive set of handbooks for wide-ranging travelers to carry in their cars or luggage, if all were turned out as well as this one. There is a natural tendency to be wary of the "complete" guide to practically everything in one package, but this one looks as if it should work. The art—full color, halftone, and line—is generally very good indeed. There are numerous habitat maps, those for birds showing summer, winter, and all-year ranges. A very useful item is the Machol Edge Index (or similar patent).

**Windows in the Woods.** By Heinz Sielmann. Translated from the German by Sidney Lightman. Introduction by E. Thomas Giliard. Foreword by James Fisher. Harper & Brothers, New York. 1959. 139 pp., 4 full-color and 60 black-and-white photographs. \$4.95.

With great ingenuity guiding his technical skill, and considerable daring, a German naturalist-photographer has succeeded in observing and recording the home life of woodpeckers—within their holes high in the upper story of the forest. He succeeded in building glass windows in the sides of nest holes without causing the birds to give up and go elsewhere to seek some more tranquil housing. Illuminating his candid studies of woodpecker domesticity with infrared camera lights, Heinz Sielmann has astonished such seasoned naturalists as Konrad Lorenz and James Fisher with his graphic achievements. His story will fascinate not only bird lovers but everyone who thrills to discovery of the ways of wild creatures.

**The Living Laboratory: 200 Experiments for Amateur Biologists.** By James Donald Witherspoon and Rebecca Hutto Witherspoon. Doubleday & Company, Inc., Garden City, New York. 1960. 256 pp., profusely illustrated in line. \$3.95.

**101 Simple Experiments With Insects.** By H. Kalmus. Doubleday & Company, Inc., Garden City, New York. 1960. 194 pp., 39 text figs. in line. \$3.95.

Science Fair time is coming around again soon—at the California Academy of Sciences and all over the nation. Here are two books ideally suited to the needs of science students and their teachers, in preparation for Fairs, or for regular biology class use. Both can also be profitably put to work "on your own." The Witherspoons, of Purdue, both laboratory experts, take students through their book into the realms of tissues and embryos, heredity, nerves and brain, seeing, hearing, balance, glands, muscles and energy, digestion and nutrition, circulation, breathing—the world of animal physiology. It is good that they have appended a page of "National Science Fair Regulations for Experiments with Animals." Dr. Kalmus of London's University College develops in his book a whole range of principles while sticking to insects as subjects.

**Ra'ivavae.** By Donald Marshall. (Review continued from page 8)

where the aging Stimson left off. A linguist, methodical organizer, veteran of Pacific ethnological exploration, Donald Marshall has proven himself at one stroke, with his work on *Ra'ivavae*, both endowed with the qualities of mind it takes to be first rate in his field and gifted as an interpreter of such work to an interested reading public. His story lives up to all the expectations conjured in the subtitle.

D.G.K.

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**"Sing of Swans" and-so-ons**

AUTHOR Henry H. Sheldon (PD, Nov.-Dec. 1960, pp.17-19) received the following fan mail and kindly passed it on to the editor:

Dear Mr. Sheldon:

Today [a friend] shared with me your... exceptional article on swans in *Pacific Discovery*. I am so delighted to discover this fine

magazine and am sending immediately for a subscription and will be looking forward with keen interest to the pleasure of reading such informative and beautiful articles as I saw today.

Most of my childhood was spent in Victoria, B.C., where the swans and ducks of Beacon Hill Park were a cherished pleasure, so of course I loved your beautiful photographs. In many years of beachcombing, I have been especially interested in the black and white murrets—I have no scientific knowledge of birds, but I have been impressed with the behavior of these murrets—the way they stand with their beaks pointing straight at the sky for such long periods at a time. And then when I had a cabin up in the Cascades near Monte Cristo, Washington, on the side of Green Mountain, for five years on week ends I watched the wonderful aerial "ballets" of hawks. So I have hopes that this fine Western magazine is going to teach me some knowledge about all the natural wonders that have fascinated me all my life.

I just want to tell you how much I appreciate your beautiful article and the discovery of *Pacific Discovery*. DENISE FARWELL [Portland, Oregon], 4 January 1961.

Thanks to Mr. Sheldon, and to Mrs. Hollis Farwell for the subscription already received. Assuredly there is no end to the parade of natural wonders of which we shall continue to present the infinitesimal part our few pages can hold in type and halftone.

Other authors who have recently heard directly from interested readers are O. Richard Norton whose "Hardware from Heaven: the Story of Meteorites" (PD, Nov.-Dec. 1960, pp. 26-28) drew "a word of very deep appreciation" from the Academy's esteemed friend Mr. C. M. Goethe of Sacramento; and Arthur C. Smith, whose plea "To Keep This Forest Primeval" (PD, Mar.-Apr. 1960) reached Mrs. Horace R. Laughlin of Palo Alto via a newsstand. Her 20 November 1960 letter begs us to put PD on more newsstands, and suggests "that somebody would do well to publish some little stories about California and the West 'just as it was before the white man came'." We thank Mrs. Laughlin for her subscription, and our many other subscribers for theirs—and everybody who takes the time to send ideas has our warmest appreciation. We need them!

We also admit to a liking for kind words from fellow editors, a nice example of which Mr. Sheldon sent us from The Bend

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## academically speaking

THE STEINHART AQUARIUM of the California Academy of Sciences first opened its doors to the public on 29 September 1923, and immediately became one of the most popular public institutions in San Francisco, a popularity which has only increased with the passing of the interim years. Today, the Aquarium—when put in juxtaposition with the other magnetic features of the Academy complex—could be called the Number One Tourist Attraction of the entire Bay Area. (Last year over 2,500,000 visitors sustained this fact.)

Ignatz Steinhart, a public-spirited citizen of turn-of-the-century San Francisco, was vitally concerned that the city should have a public aquarium. He zealously visited all of the aquaria in America and Europe, employed experts to delve into aquarium problems, and discussed at length the cost and best location for the one he had in mind to make as a gift to San Francisco.

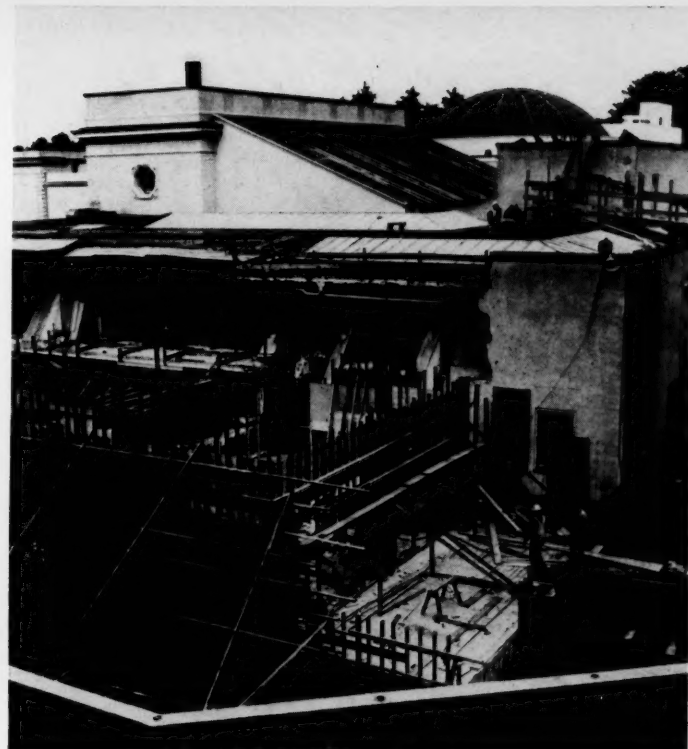
Unfortunately, Mr. Steinhart did not live to see the physical fruition of his dream for he died suddenly in 1917, but his will provided \$250,000 "for the erection and completion of an aquarium to be located in Golden Gate Park . . . adjacent or adjoining the . . . Academy of Sciences."

The Aquarium finally opened, to complete success. The years passed. The quantity and quality of its displays increased and millions of visitors came and went. But beyond and back of the glittering and colorful watery wonderland, years and salt water were having their corrosive effects and no finances were available to stay the relentless hand of Time. As was pointed out in the Academy's 1958 Annual Report, "Thirty-five years is young for a man, old for a horse, and for an aquarium we may charitably say elderly." It often became a moot question whether or not the doors of Steinhart could be kept open.

The civic-mindedness of San Franciscans being what it is, however, a bond issue of \$1,575,000 was given the "everlasting yea" on the June 1958 ballot for a complete rehabilitation of the Aquarium. (The figure is poignantly interesting when compared to that of Mr. Steinhart's initial bequest.)

At 8:07 on the morning of 26 September 1960, 37 years less three days later than the grand opening, the rattle of jackhammers was heard and the lengthy process of restoration—and extension—of Steinhart Aquarium had begun.

Rehabilitation is planned to take place in three stages, the first of which is now underway with the display areas



What's going on at Steinhart Aquarium: The open deck with a sawhorse, and two men walking on from the right, is the top of a 100,000-gallon salt water reservoir which extends all the way across to the left, outside the picture. Above it, middle foreground, will be the garage for our collecting trucks; and above that, new holding tanks and a hoist. The inner forms at the far left are for the new 67,000-gallon porpoise tank. (DCK)

being one sixth cut off. Later this year, probably during the summer, Steinhart Aquarium will be completely closed to public view. But, come early 1962, the doors will open once again to a newer and larger and more exciting Steinhart than its original benefactor could probably have imagined or dared to foresee.

H.R.

[Oregon] Bulletin—a 13 Dec. 1960 editorial entitled "Henry Sheldon's contributions valued": Bend, its scenic setting, its Mirror Pond and its waterfowl obviously made a deep impression on Henry Sheldon, naturalist and photographer, during his many years of residence here.

This is indicated by his frequent mention of Bend in his impressively illustrated articles, one of which appears in the current issue of *Pacific Discovery*. The publication holds a three-page story dealing with the Mirror Pond swans. . . .

Editor and publisher of this "independent newspaper" is Robert W. Chandler. Phil F. Brogan is associate editor; William A. Yates, managing editor. We're happy to list them among our readers.—Ed.

Editors have reason to wish scientific people would not spend so much time revising, that is, changing the names of things. Last issue we presented part of what was represented to us as a collection of marine algae—mounted specimens, all duly labeled with their scientific names. Now it comes out: one of these was a ringer—a mere hydroid—and most of the rest are masquerading under their old right names. Now we would argue that changing the names is no protection to innocent editors. But nevertheless we do thank Dr. Isabella Abbott of Stanford University's Hopkins Marine Station for the kindly interest in setting records straight with which she brought these facts of marine algae life to our attention. She writes from Pacific Grove, California, 27 January 1961:

. . . Do have the list corrected from which you took the scientific names applied to the lovely photographs of seaweeds in the Jan.-Feb. PD. . . . Mrs. Hall's collection is a historically important one for California, and it would be too bad if the algae were not named correctly. . . . If I ever get my seaweeds in good order, I might do a little research some day on the "old ladies" who collected algae on this coast around the turn of the century—there are many genera and species named for them (Mrs. Hall included). I have never met anyone who really knew them and could give some history outside of their love for plants, but I hope I'll find somebody soon. . . . [The corrections Dr. Abbott sent us follow.]

Page 13. FOR *Halidrys* READ *Cystoseira*; FOR 1812 READ 1912 [no editorial excuse for this one!]. Page 15: FOR *Nitophyllum ruprechtianura* READ *Hymenena flabelligera*; FOR *Callophyllis flabellata* READ *C. obtusifolia*; FOR *C. variegata* READ *C. marginifurcata*; FOR *Padina pavonia* READ *P. pavonica*; *Aglaophoena struthionides* is the hydroid (presumably under its right name); FOR *Nitophyllum spectabile* READ *Hymenena setchellii*; FOR *Gigartina padula* READ *G. californica*; FOR *Chrysomenia* READ *Botryocladia*; FOR *Callophyllis furcata* READ *C. megalocarpa*. [It will be a cold, foggy Pacific Coast day in summer before we take on the algae again, Dr. Abbott!]

One more correction to the last issue: Page 22: FOR San Joaquin County School District READ Stanislaus County . . . (Error in copy sent us.)

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